LOGIC ANALYZERS
PM 3580 / PM 3585
Reference guide

PHILIPS

Dual logic analysis

PF8690/00 System Software
Software Version 1.0, English
I&E, Test & Measurement
© Copyright 1990, Philips Export B.V.

Publication Number 4022 104 90161

Copyright ©1990, Philips Export B.V.
Printed in the Netherlands

Table of Contents

Introduction 1
- Front Panel 2
- Rear Panel 3
- Field Types 4
- Menu Bar 6
- Moving in Menus and Lists 7

Configuration Menu 9
- Analyzer Name 10
- Analyzer Status 11
- Software Options 11
- Analyzer Reset 11
- Pods 12
- Pod Activity 12
- System Reset 13

Format Menu 15
- Analyzer Name 17
- Pod Activity 17
- Thresholds 17
- Clock Labels 18
- Clock Polarity 19
- Clock Selector 20
- Clock Qualifier Expression 22
- Data Labels 22
- Data Polarity 23
- Label Selector 24

Clock Attributes Menu 25
- Timing Label 26
- Qualifier(s) 27
- Display Position 27

Label Attributes Menu 29
- Timing Label 30
- Clock Validity 31

Trace Menu 33
- Pattern Recognition 35

Run Definition 37
- Analyzer 37
- Sequence Type 38
- Type of Data Stored 39
- Trigger Position 40
- Run Mode 42
- Run Parameters 42

Predefined Sequences 44
- Timing Sequences 45
- State Sequences 46

Last User-defined Sequence 47
Sequencer 48
Store Condition Fields 50
Level Number 51
After Condition 52
If / Or if / Restart Conditions 53
Times 55
Goto 56
Trigger 56
Trigger Words 58
Trigger Word Name 59
Clock Used / Filter Time 60
Base 62
Pattern Fields 62
Input/Output Menu 65
I/O Popup Menus 67
Load New and Settings 68
Save New and Settings 69
Define Autoload 69
Copy File 69
Rename File 70
Delete File 70
Format Disk 70
Timing Display 71
Analyzer Name 73
Time per Division 74
X Position 75
R and S Positions 76
Display Special Functions 77
State/Timing 77
Data Source 77
Y Scale 78
Dial Operation 78
Mode 79
Cursor Difference R-S 80
Displayed Value 80
Label Name 81
Bus Fields 82
Level 83
Polarity Fields 83
Value Fields 83
State Display 85
Analyzer Name 87
Disassembler Switch 88
Y Position 88

R and S Positions 89
Display Special Functions 90
State/Timing 90
Data Source 91
Disassembler Parameters 91
Dial Operation 91
Mode 92
Cursor Difference R-S 93
Label Name 93
Base of the Data 94
Display Special Functions Menu 97
Display Type 98
Coscrolling 99
Sample Number Fields 99
Copy New to Reference 99
Exchange New and Reference 100
Disassembler Parameters Menu 101
Program Context Mode 102
Program Context Mode 102
Program Context Mode 102
Show Data Transfers 103
Restart 104
Synchronization 104
At Y 105
Options 106
Print Menu 107
Print Screen 108
Dump Screen 108
Cancel 108
Acquisition Progress Display 109

Introduction

This Manual

The *PM 3580/PM 3585 Reference Guide* is organized per menu. Given a menu, it concisely describes per field the purpose of the field and all the possible options.

Other Manuals

The *PM 3580/PM 3585 Getting Started Guide* leads you through the different menus by means of a number of examples.

The *PM 3580/PM 3585 User Manual* gives background information with respect to the concepts implemented in your instrument.

The *PM 3580/PM 3585 Service Manual* helps you in troubleshooting and repair at module level. It also contains the performance verification procedures.

This manual is the Reference Guide for the PM 3580 and PM 3585 Logic Analyzers.

The manual is organized by major screens, and then by fields on the screens. There are five major screens, plus five important pop-up menus. The major screens relate to five of the menu keys. (See the front panel shown at the bottom of this page.) The menus are:

Configuration: assigns pods to an analyzer.

Format: defines labels and thresholds for channels and external clocks.

Trace: defines sequencer operation and data storage.

Display: shows data captured.

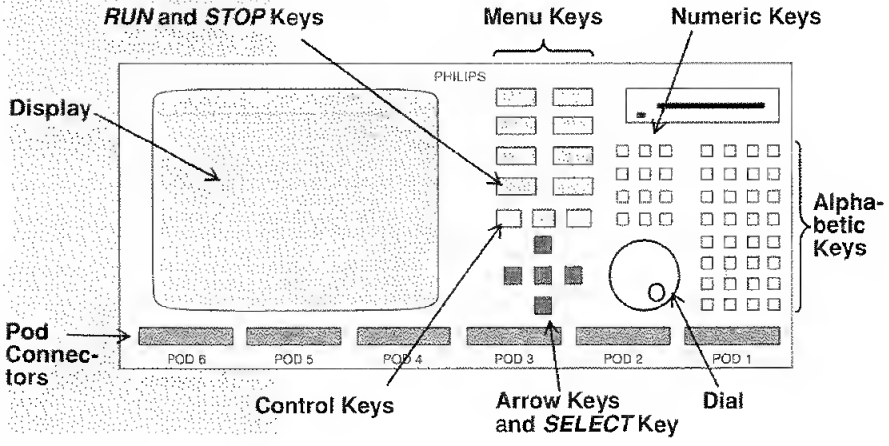
I/O: allows disk access.

Screens and Field names can be found in the table of contents at the beginning of the manual, and also in the index at the back of the manual.

This introduction explains the layout of the instrument and terms and operation common to the menus.

Front Panel

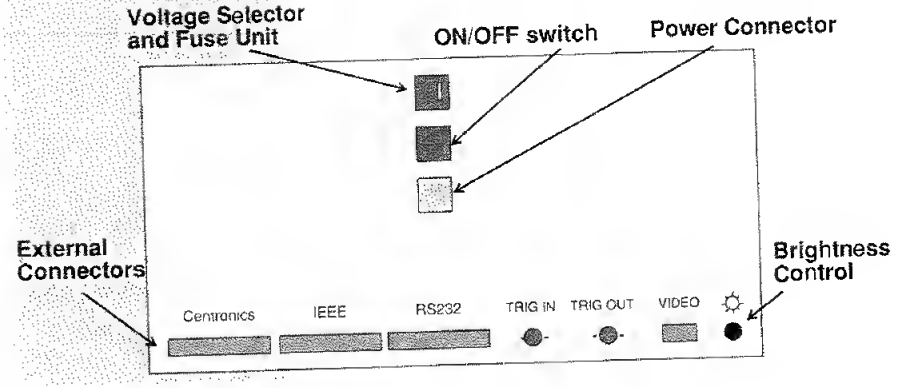
The Front Panel of the Logic Analyzer is shown below.



Rear Panel

The rear panel contains the other external connections and the power switch, as shown at the bottom of this page. The following connectors are located at the bottom of the panel from left to right:

Centronics:	A female 25-pin 'D' connector for the attachment of a parallel printer with a Centronics interface. (Epson standard or equivalent.)
IEEE:	optional IEEE-488 (24 pins) connector for remote operation.
RS232:	A male 25-pin 'D' connector for the attachment of a serial mouse.
TRIG IN:	A male BNC connector by which a trigger pulse from another instrument can be input to the logic analyzer.
TRIG OUT:	A male BNC connector for supplying an external trigger pulse from the Logic Analyzer to another instrument.
Video:	A 15-pin 'D' connector for the attachment of an external 32kHz (i.e., analog MVGA) monitor.



Brightness control (☼):

Increases or decreases the screen intensity.

In the center top of the rear panel is the voltage selector and fuse unit.

CAUTION

The selected voltage MUST match your line (mains) voltage: otherwise, you can damage the instrument.

Below the voltage selector and fuse unit is the main instrument ON/OFF switch; below that is the connection for the power cable.

Field Types

In the description of the menus in this manual, each menu field is described by Purpose and Type. In addition, where useful, Operation, Effect, Notes etc. are used.

In using this manual, it will help if you understand what is meant by the *type* of a field. The types of field are briefly described below. For more details about the user interface, please refer to the *PM 3580/PM 3585 User Manual.*

Information:

The data shown in these fields cannot be changed directly.

Editable: These are fields where you specify names of items such as signal and clock labels . You can use all the letter and number keys, including the decimal point, slash (/), space and underscore keys. The *INS* key (right of front panel) toggles between insert and overwrite mode. Use the arrow keys or the dial to exit.

Numeric: (Integer and real). These fields are used for entering numeric data. Data is entered in calculator style; each number entered at the right,

pushing the other numbers left. Only numeric characters, the backspace key (←), the decimal point, and the +/- key are allowed. For integer numbers, the decimal point and +/- keys are ignored. Use of any other key ends the edit mode.

Toggle: On these fields, press *SELECT* to toggle the items cyclically around the predefined values. Where the predefined items are + and –, you can also toggle using the +/- key.

Check: This is a special kind of toggle field. Their predefined values are • and ✔. The dot • indicates that the item associated with this check field is not selected, the check ✔ that it is selected.

First Character Select:
Press the initial character of one of the options. (The appropriate options are shown in this manual.) Alternatively press *SELECT* to show the list of options.

List: In these fields, the first character selection is not available. Press *SELECT* to show the list of options.

The "▶" symbol after an option on a list indicates that on pressing *SELECT* or the right arrow on the option, a list or pop-up menu is shown appropriate to the option. When this "child" menu is closed, the "parent" menu is closed too.

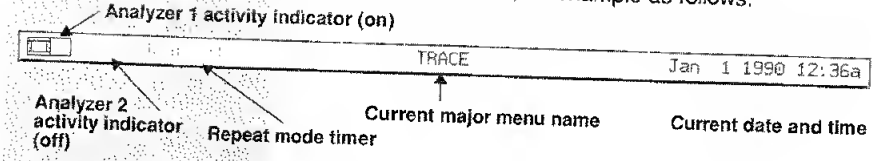
Pop-up Menu:
Press *SELECT* to show a pop-up menu. The first field of any pop-up menu, in the *home* position, is the return field. Select this to indicate that all changes have been made on the pop-up menu and to close the menu. This is a function field (see below).

Function: When you press *SELECT* on a highlighted function field, the action described by the field is performed.

Information fields are shown with black text on a light gray field with a black border. Other fields are shown with black text on gray with no border. The highlighted field has a white background and black border. Fields that are currently unselectable fields have gray text on light gray with a gray border.

Menu Bar

The five major menus each have at the top a menu bar which provides information about the current, general status of the instrument, for example as follows.



Activity indicator:

There is only one Analyzer activity indicator on PM 3580 instruments.

When an analyzer is active (status = active in Configuration menu) but not running, the appropriate activity indicator is *dark gray*.

When an analyzer is inactive, the appropriate activity indicator is *light gray*.

When an analyzer is active and acquiring data, the appropriate activity indicator *'flashes'*.

Repeat Mode Timer:

If auto-repeat is defined but not active, the repeat mode time is *light gray*.

If auto-repeat is defined and active, the repeat mode time is *dark gray and counting down* during the time interval between runs.

Moving in Menus and Lists

Arrows move the highlight in the direction they point, wrapping to the beginning of the next line, and scrolling the screen when there is more to display.

Moving the dial clockwise moves the highlight as in reading, from left to right and then top to bottom, then wrapping to the top.

On lists, you can also enter the initial character to go to and select an item. Press *DELETE* or left arrow to close the list without action. If in a "child" of a list, this returns you to the "parent" list.

The *HOME* key takes you to the top left of any menu, screen area or pop-up menu, and to the top of a list.

CONFIG

Configuration Menu

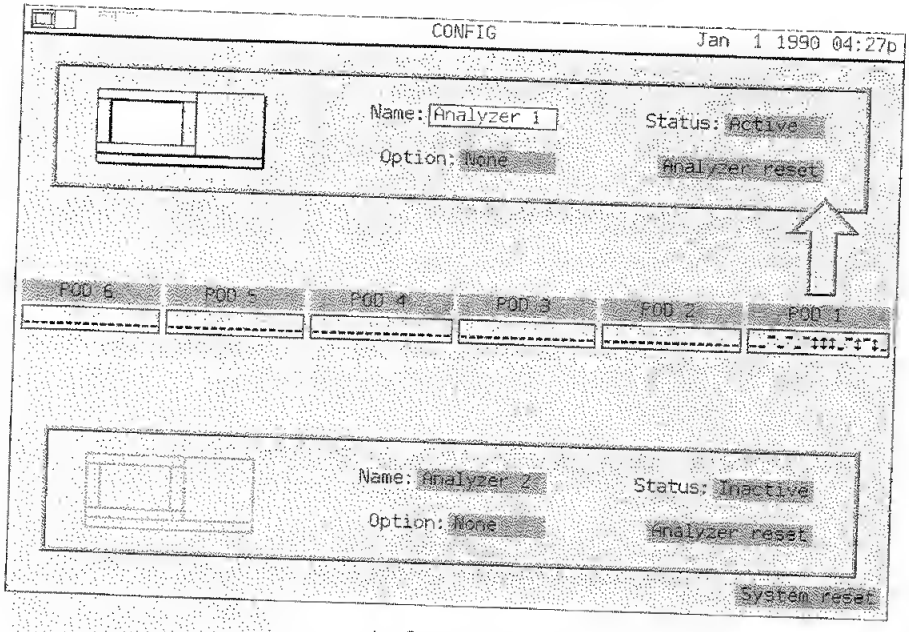
Menu Access

The configuration menu is normally the first screen shown on start-up. It can be accessed at any time by pressing the *CONFIG* key.

Menu Purpose

This menu is used to set up the main configuration of a measurement session. Thus assigning the pods to an analyzer and choosing a disassembler.

The options chosen on this screen affect most of the other menus.



On the Configuration menu, the fields shown in the lower box associated with Analyzer 2 are equivalent to those of Analyzer 1 described in the following. The lower box is not present on PM 3580 instruments.

Analyzer Name

Name: Analyzer 1

Purpose: Change the name of the analyzer to provide a meaningful name for the current measurement session.

Type: Editable. (Type in new name.)

Effect: Changes analyzer field names on all screens and peripheral output.

Defaults: *Analyzer 1:* "Analyzer 1".
Analyzer 2: "Analyzer 2" (not PM 3580).

Analyzer Status

Status: Active

Purpose: Set the Analyzer function on and off.

Type: Toggle – *Active / Inactive.*

Effect: While an analyzer is inactive, no new data is captured for the pods connected to it.

Defaults: *Analyzer 1:* Active.
Analyzer 2: Inactive (not PM 3580).

Software Options

Option: None

Purpose: Defines the software option, e.g., the disassembler, to be used as available on the inserted floppy disk.

Type: List. (Press *SELECT* for a list.)
All options found on the current disk are shown, plus the option *None* . If no options are found, only "*None*" is shown.
Warnings are given if there is no disk present or there are no options on the disk.

Effect: Changes the items defined by the option and, if defined, a disassembler field appears on the display state list. The items defined are option dependent and are shown in the appendixes of the *PM 3580/PM 3585 User Manual.*

Analyzer Reset

Analyzer reset

Purpose: Resets the analyzer to its defaults.

Type: Function. (Action done on selection.)

Effect: Changes all menus:
For **Analyzer 1**:
- After reset, only one pod (the first available) is assigned.

- All labels are reset.
- Trace sequence, run definition, and trigger words are reset.
- The status is set to *Active*

For **Analyzer 2:** (not PM 3580)

- After reset, no pods are assigned.
- All labels are reset.
- Trace sequence, run definition, and trigger words are reset.
- The status is set to *Inactive*.

Pods

POD 1

Purpose: Assigns a pod to either analyzer or to neither.

Type: Toggle (PM 3585): Analyzer 1 / Analyzer 2 / none.

Toggle (PM 3580): Analyzer 1 / none.

Operation: When the field is highlighted, pressing *SELECT* causes an arrow to point to analyzer 1, to analyzer 2 (not PM 3580), or to disappear. This indicates the assignment of the pod. Pressing *DELETE* causes the arrow to disappear.

Effect: Signals from pods assigned to an analyzer that is active can be used in state and timing measurements and for triggering.

Defaults: *Pod 1:* assigned to Analyzer 1.

Other pods: unassigned.

Pod Activity

Purpose: Shows the current activity of the signals of the associated pod. Activity is high (‾), low (_), or changing (↕).

Type: Information.

Note: Whether activity is measured depends on the threshold values set for a pod (on the Format menu).

System Reset

System reset

Purpose: Resets instrument to start-up condition.

Type: Function. (Action done on selection.)

Operation: On selection, a confirmation pop-up menu (Yes/no) is shown. If you select *Yes*, the system is first reset to the factory pre-set condition. If there is an autoload file on the disk, this is then loaded.

Effect: Affects all fields on all menus.

FORMAT

Format Menu

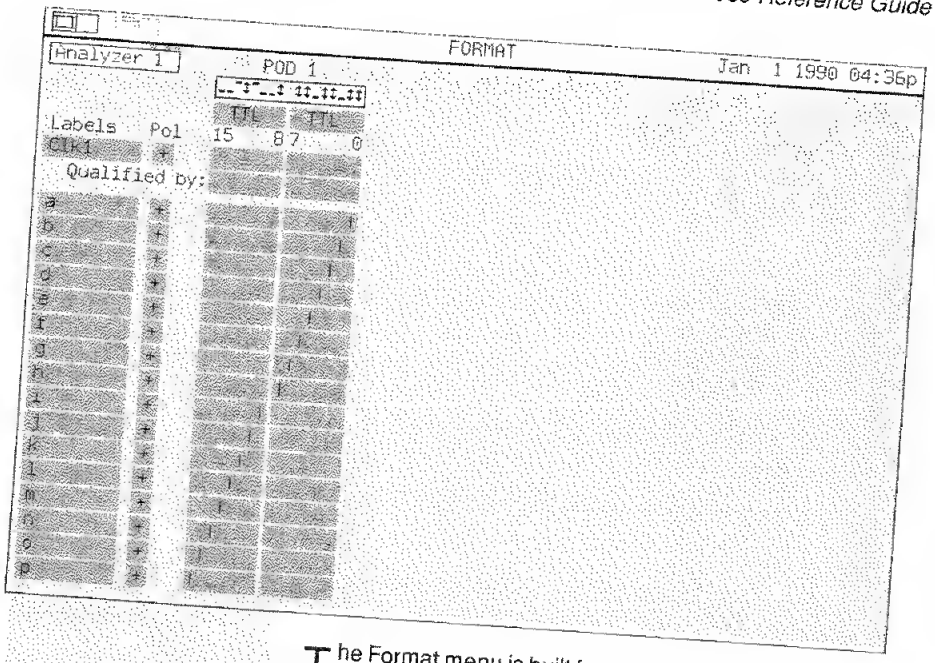
Menu Access

The format menu can be accessed at any time by pressing the *FORMAT* key.

Menu Purpose

The primary purpose of this menu is to set up the pod thresholds for all assigned pods, to set up the external clocks and their qualifiers, and to set up the labels and polarities for each channel and clock.

Further parameters can be set by the use of pop-up menus on the clock and label fields. These menus are described in the next two chapters.



The Format menu is built from the fields described on the following pages.

The number of pods shown in this menu depends on the number of pods assigned to the analyzer in the Configuration menu.

Only four pods can be shown at a time in this menu. When more than four pods are associated with an analyzer, the left and right arrow keys can be used on the end fields, as appropriate, to scroll to the other pod or pods.

Note: The dial does not cause the pod matrix to scroll.

Analyzer Name

Analyzer 1

Purpose: Shows which analyzer the following fields refer to and switches between the two analyzers.

Type: Toggle (PM 3585): Analyzer 1 / Analyzer 2
Information (PM 3580).

Note: (PM 3585 only) If no pods are assigned to an analyzer, that analyzer is not selectable.

Effect: Changes which screen is displayed .

Pod Activity

POD 1

Purpose: Shows the current activity of the signals of the associated pod. Activity is high (‾), low (_), or changing (‡).

Type: Information.

Note: Whether activity is measured depends on the threshold value set for the pod (see next item).

Thresholds

TTL TTL

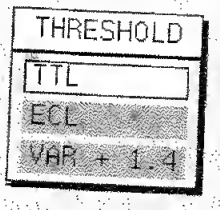
15 8 7 0

Purpose: Defines the threshold level for the indicated byte of the pod.

Note: Those signals above the threshold are physically high, those below the threshold are physically low. (See also the polarity field for the representation of the signal.)

All eight channels of a pod-group have the same threshold.

Type: First Character Select/Numeric (see operation below).



Operation: Depends on the key pressed:

SELECT:

a list, as shown in the margin, appears (see T, E and Var threshold below).

T: select TTL threshold. Value +1.4 V.

E: select ECL threshold. Value -1.3 V.

V: select var threshold. Value as last set up, default +1.4 V.

0-9 or decimal point:

select and set up Variable threshold. (Also on Var field of list.)

Range -3.0 V to +12.0 V in steps of 0.1 V.

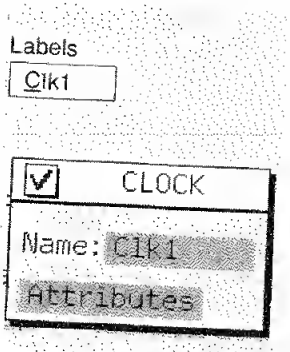
left and right arrows:

move and scroll as described at the beginning of the chapter.

Effect: Affects pod activity indicators and data acquisition.

Default: TTL.

Clock Labels



Purpose: Specifies the name for the external clock and select special clock attributes.

Type: Editable/pop-up menu (see operation).

Operation: Depends on the key pressed:

alphanumeric keys:

change the name of the clock.

SELECT:

causes the pop-up menu at left to appear. The fields are:

Name: change the name of the label. (Editable field.)

Attributes: pressing *SELECT* when on this field causes the special clock attributes pop-up menu to appear. This is described in the next chapter "Clock Attributes Menu" beginning on page 25.

INSERT:
allows you to add another clock if there are clock qualifiers available (see sidebar below).

DELETE:
allows you to remove the current clock. You may not remove the last clock.

Clock Polarity

Pol
+

Purpose: Selects between positive and negative logic.

Type: Toggle: + / –.

Operation: Depends on the key pressed:

SELECT and ***+/–:*** toggle polarity.

INSERT and ***DELETE:*** operate the same as for clock label above.

Notes: Positive logic is defined as when the physical high level of a signal is logical high (+), negative logic as when the physical high level of a signal is logical low (–).

Qualifier Expressions and Clocks

There are a maximum of four clocks and four qualifier expressions available which may be selected from any of the available channels. A clock may be qualified by any or all (*OR*ed) of the four qualifier expressions. A given qualifier expression, however, may be assigned to only one clock. A channel assigned to a clock label cannot be assigned to a data label.

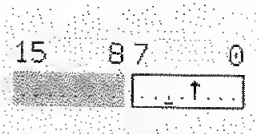
Note that a clock always uses a qualifier expression, even if the expression is empty and not shown.

Changing to and from negative logic updates trigger word defintions accordingly.

Effect: Changes display of information, triggering and clocking (for clock signals).

Default: Positive logic, logical high (+).

Clock Selector



Purpose: Selects a channel to be used as an external clock and specifies the active edge.

Type: Toggle channel:

- ↓ selects the falling edge.
- ↑ selects the rising edge.
- ↕ selects either edge.
- • deselects the channel.

Note: If a channel is already assigned to other clocks, assigning it to a new clock with a different edge will change the edge on those other clocks.

Operation: See side bar on next page.

INSERT (in non-edit mode) adds a qualifier expression or alternative qualifier expression (Or by:) if available (see side bar on page 19).

SELECT in edit mode causes a pop-up query menu to appear if the channel has already been assigned. If you accept, the existing assignment is removed and the clock channel is assigned.

Effect: Changes state data acquisition and triggering. If no clock is defined, state data acquisition is not possible. Default of trace menu data stored field is changed to State+Timing.

Default: No channel assigned to clocks (timing acquisition only.)

Key Usage in Channel Select Fields

Clock selector, Clock qualifier expression, and Label selector fields use the same key sequences:

Operation in non-edit mode:

Arrows and Dial: Move to another field as described at the beginning of this manual (page 7).

INSERT: Add a line. See specific field for what is added.

DELETE, SPACE, *or* ***• (decimal point):*** deselects the channel where the underline cursor last was in the field, enters edit mode and moves the cursor one position to the right.

SELECT: enter edit mode.

Operation in edit mode (an underline cursor is shown):

Left and right arrows and Dial: Move to the next channel. Moving out of the current field exits edit mode.

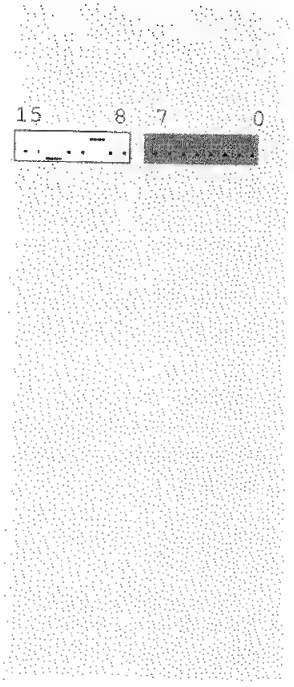
Up and down arrows: Move to another field as described at the beginning of this manual (page 7).

DELETE, SPACE, *or* ***• (decimal point):*** Operate as in non-edit mode. Moving out of the current field exits edit mode.

SELECT: toggles the channel where the underline cursor is. See specific field type for extra information.

← (backspace) deselects the channel to the left of the underline cursor, and moves the cursor one position to the left. Moving out of the current field does not exit edit mode.

Clock Qualifier Expression



Purpose: Defines the conditions that must be met before a clock is valid.

Type: Toggle channel:

- _ channel low.
- ‾ channel high.
- • channel not considered ("don't care").

Operation: See side bar on page 21. See sidebars below and on page 19 about inserting qualifiers.

Note that qualifier channels may also be assigned to data channels, unlike clock channels.

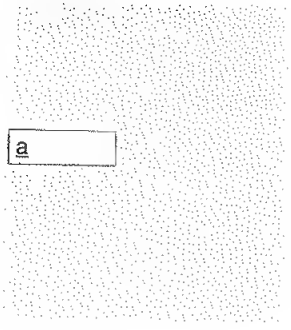
Effect: Changes state data acquisition and triggering.

Default: Qualifier fields shown, none selected.

Qualifier Expressions

- All channels within one line are ***AND***ed together.
- Qualifier expressions for one clock on different lines are ***OR***ed together.

Data Labels

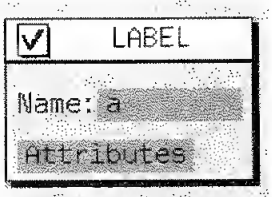


Purpose: Specifies a symbolic label to designate a channel or group of channels to obtain a more informative data display. Also selects special attributes for these data labels.

Type: Editable/pop-up menu (see operation below).

Operation: Depends on the key pressed:

alphanumeric keys: change the name of the label.



SELECT:
causes the pop-up menu at left to appear. The fields are:

Name: change the name of the label. (Editable field.)

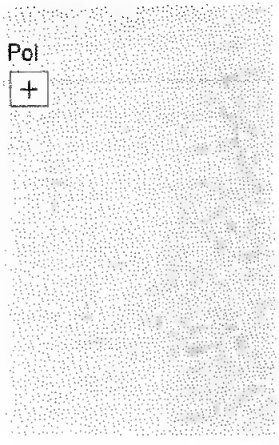
Attributes: pressing *SELECT* when on this field causes the label attributes pop-up menu to appear. This is described in "Label Attributes Menu" beginning on page 29.

INSERT: adds a label. This new label is given the next available default name. For example, if the highest letter previously used was "s", the new label is called "t". If the previous highest letter was "z", "aa" is used, etc..

DELETE: removes the current label. If only one label is left, you may not remove it: at least one label must remain on the format menu.

Defaults: 16 labels, called 'a' through 'p'.

Data Polarity



Purpose: Selects if the physical high level of this signal is interpreted as logical high (+) or as logical low (–).

Type: Toggle: + / –.

Operation: Depends on the key pressed:

SELECT and ***+/–:*** toggle the value.

INSERT and ***DELETE:*** operate the same as for the label name (above), respectively adding and deleting a label.

Effect: Changes display of information and triggering for this signal.

Defaults: Logical high (+).

Label Selector

Purpose: Define the channels associated with a data label.

Type: Toggle channels:

| active

• ignored.

Operation: See side bar on page 21.

INSERT adds a label as described in "Data Labels" on page 22.

SELECT in edit mode: In multiple channel labels (busses) the left-most selected channel is considered the most significant channel.

If you try to assign a channel to a label when that channel is already used as a clock, a pop-up menu is shown asking if you want to remove the clock assignment. A channel cannot be a data and a clock channel at the same time.

Note that the clock label appears as a data label in the trigger words area of the Trace menu, and in the labels of the Timing display.

Limitations: The maximum number of channels for a label is 32.

Effect: Changes the grouping of channels for defining trigger words and displaying data.

Defaults: The lowest number pod connected has each of its sixteen channels assigned in increasing order to labels a through *p*. Thus the least significant channel (right-most) is assigned to a and the most significant to *p*.

Clock Attributes Menu

FORMAT

Clk1

SELECT

Attributes

SELECT

Menu Access

The menu can be accessed by pressing the *SELECT* key on any clock label field on the *FORMAT* menu, then pressing *SELECT* on the Attributes field in the pop-up menu that appears.

Menu Purpose

The menu allows the attributes of a clock label to be specified.

```
ATTRIBUTES
Timing label: Data storage + Triggering
Qualifier(s): Yes
Display on same line as clock: None
```

The Clock Attributes pop-up menu is as shown above.

The fields of this pop-up menu are described below. (When finished, select the return field at top left to close the menu.)

Timing Label

Timing label: No

Purpose: Determines if the clock signal is also considered as a timing label. If so, whether it is for triggering only or also for timing data acquisition.

Type: Toggle:

Data storage + Triggering: the signal is used for both triggering and data acquisition.

No: the signal is used only as an external clock and is not used in timing analysis.

Triggering only: the signal is also used for timing analysis, but for triggering only. (No timing data is stored for this channel.)

Effect: Whether signal is seen on the Trace and Display screens.

Default: Data storage + Triggering.

Qualifier(s)

Qualifier(s): No

Purpose: Inserts the first qualifier expression or removes all qualifier expressions for the current clock from the display.

Type: Toggle:

Yes: inserts the first qualifier expression for this clock if there are none. (Subsequent qualifier expressions are inserted by pressing *INSERT* in a qualifier expression field.)

No: deletes all qualifier expressions for the current clock from the display.

Effect: Whether clock qualifier expression fields are shown for the current clock on the Format menu.

Default: Yes.

Display Position

Display on same li: None

Purpose: Demultiplexing of data. Merges state data captured by different external clocks on lines of the state display.

Type: Toggle: *None* and any other clock signals. If only one clock is defined, only the *None* option is available.

Effect: Changes how the data captured by this clock signal is shown on the state display menu with respect to state data captured by other external clocks. The time shown in the state display is that corresponding to the reference clock.

Default: None. (State data samples captured with this clock get their own line in the state list display.)

FORMAT

a

SELECT

Attributes

SELECT

Label Attributes Menu

Menu Access

The menu can be accessed by pressing the *SELECT* key on a data label field on the *FORMAT* menu, then pressing *SELECT* on the Attributes field in the pop-up menu that appears.

Menu Purpose

The menu allows the attributes of a data label to be specified.

```
ATTRIBUTES
Timing label: Data storage + Triggering
Valid for Clk1: Yes
```

The Label Attributes pop-up menu is shown above.

The fields of this pop-up menu are described below. (When finished, select the return field at top left to close the menu.)

Timing Label

Timing label: No

Purpose: Determines if the label is also considered as a timing label. If so, whether it is for triggering only or also for timing data acquisition.

Type: Toggle:

Data storage + Triggering: the signals assigned to the label are used for both triggering and data acquisition.

No: the signals are not used in timing analysis.

Triggering only: the signals assigned to the label are also used for timing analysis, but for triggering only. (No timing data is stored for this channel.)

Since transitional timing is used, this can be used to inhibit the storage of rapidly changing signals of little interest so that the recording length of the data acquisition is extended.

Effect: Whether the signal is seen on the Trace and Display screens.

Default: Data storage + Triggering.

Clock Validity

Valid for Clk1: YES

Purpose: Specifies whether the related label is used as state data and for which external (state) clocks this data is valid.

Type: Toggle: *Yes / No.*

Operation: The number of fields shown on this line depends on the number of clocks that have been defined. (There can be a total of four clocks.) This effectively means that the external clocks are ORed together.

Effect: Changes the trigger word area in the trace menu and state data display in the display menu.

Default: Yes for all clocks (whether channels are assigned to this label or not).

TRACE

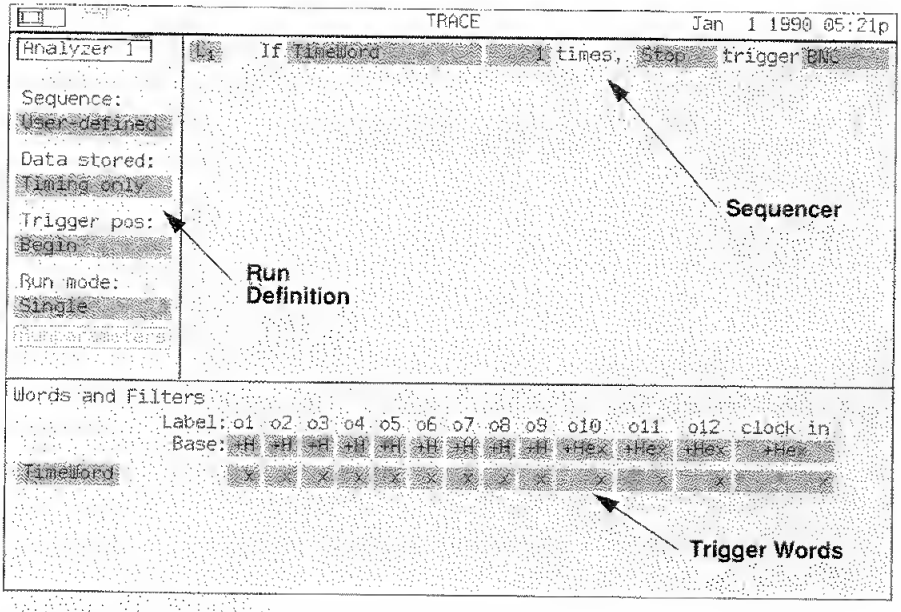
Trace Menu

Menu Access

The Trace Menu can be accessed at any time by pressing the *TRACE* key.

Menu Purpose

This menu lets you define the settings of the sequencer and various other parameters which define the acquisition. This determines which patterns are searched for and in what order, and which data is stored.



The trace menu lets you define the patterns and sequence of patterns that must be recognized in the data, resulting in a triggering of the acquisition hardware.

For state acquisitions this menu also lets you specify which particular samples should be stored.

The trace menu is divided into three areas. Moving clockwise, these are Run Definition area, Sequencer area, and Trigger Words area, as shown above.

Each area is described in a separate section following. First, however, is a section "Pattern Recognition" which describes the related terms.

On first displaying the menu, the cursor (highlighted box) is on the analyzer field in the Run Definition area.

Moving between areas is done, as usual, by using the cursor keys. However, by pressing the *TRACE* key, you can move clockwise to the last field you selected in each area. The dial moves only within an area.

Pattern Recognition

Words are the AND combination of bit (0, 1, x) patterns in each label.

TimeWord

If specified, all timing samples captured are compared against the TimeWord.

tw_7 and tw_8

If specified, all timing samples captured at 20 ns intervals are compared against tw_7 or tw_8 or both.

Note: tw_7 and tw_8 may alternatively be used as a state words sw_7 and sw_8 respectively.

Time Filters

These may be used used in combination with tw_7 and tw_8 to recognize patterns occurring for more or less than a specified time period. The time period can be 20 ns through 1.31 ms in steps of 20 ns.

Glitch Detector

This detects signals less than the minimum sampling period. If specified for more than one channel, glitch detection is ORed. It may be used in isolation or in combination with a pattern.

Edge Detector

Detects a specified change of state for one or more signals. If specified for more than one channel, edge detection is ORed. May be used in isolation or in combination with a pattern.

State Words sw_1 .. sw_8

If specified, all state samples captured with the state clock specified with the state word are compared against the state word.

Note: sw_7 and sw_8 may alternatively be used as timing words tw_7 and tw_8.

Immediate State Words sw_{12} .. sw_{78}

Immediate word sw_{xy} is used to detect the occurrences of sw_x and sw_y in two consecutive state samples, with sw_x being the first recognized.

Range

Identifies data which is numerically between or on two specified patterns RangeH and RangeL. Ranges specified per label are ANDed, e.g.,

Range = (Address in address range) & (Data in data range).

Not State Words $\overline{sw_1}$ .. $\overline{sw_8}$

As state words but true if the sample captured does not match the state word specified.

Not Range

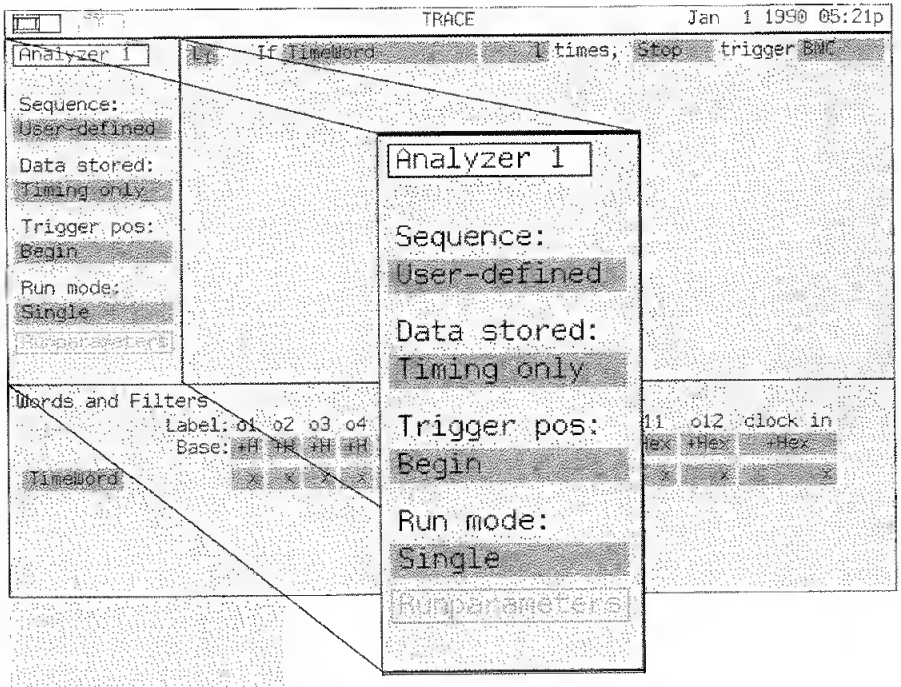
Identifies data which is numerically neither between nor on two specified patterns RangeH and RangeL. Not range is thus the inversion of range, so for example:

$\overline{\text{Range}}$ = not {(Address in address range) & (Data in data range)}.

State Clocks

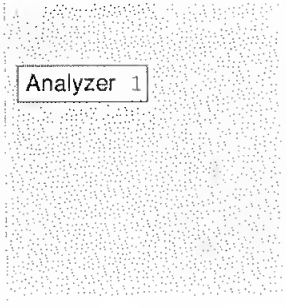
State clocks may also be used as patterns themselves for both triggering as well as storage qualification.

(For more details on Pattern Recognition see the *PM 3580/ PM 3585 User Manual.*)



In the run definition area you specify for which analyzer you are defining the sequence and patterns, and the general parameters to be used for the acquisition run.

Analyzer



Purpose: Switches between trace information for analyzers 1 and 2.

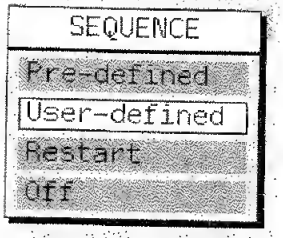
Type: (PM 3585) Toggle: Analyzer 1 / Analyzer 2.
(PM 3580) Information only.

Effect: Changes displayed screen to that for the analyzer specified.

Default: Analyzer 1.

Sequence Type

Sequence:
User-defined



Purpose: Defines the type of sequence to be used in the sequencer area.

Type: First character select. Press *SELECT* to get list of the following options:

Pre-defined: causes a list of pre-defined sequences to be shown in the sequencer area from which one can be selected. This is described in "Sequencer" beginning on page 48.

User-defined: allows you full control over every option of the sequencer. This is described in "Sequencer" beginning on page 48.

Restart: the same as user-defined, except that the *or if* condition is used as a restart condition. That is, at each level it forces the sequencer to go to level 1 if the restart condition occurs. (Thus it *restarts* the sequence.)

Off: switches the sequencer off for this analyzer. With the sequencer off, the analyzer triggers immediately after *RUN* is pressed, then fills the complete memory.

Note: When user-defined is selected while predefined sequences are displayed in the sequencer area, the currently selected (ticked) predefined sequence is used as a template for the user-defined sequence.

Effect: Changes sequencer area and possibly trigger words area.

Default: User-defined.

Type of Data Stored

Data Stored:
Timing only

DATA STORED
Timing only
Timing+Glitch
State only
Timing+State
Auto

Purpose: Defines the type of data to be stored.

Type: First character select. Press *SELECT* to get a list of the following options:

Timing only: Only timing information is stored, using full memory depth (see side-bar at foot of the page).

Timing+Glitch: Both timing and glitch data are stored, each using half of memory depth.

State only: Only state data is stored, using full memory depth.

Timing+State: Both timing and state data are stored, each using half of memory depth.

Auto: Changes the data stored to be the most appropriate for the defined situation:

- Timing+State if external clocks defined,
- Timing+Glitch if a predefined option including glitch is selected,
- Timing only otherwise.

Type of Data Stored and Memory Depth

The Logic Analyzer has a certain amount of memory available for sharing between state and timing data acquisition (2K/1K depth per channel on PM3585/PM3580 systems). Therefore, by specifying that only one type of data is stored, all of the memory is available for that type.

Note:
Time tags are stored in separate memory, so the above 2K/1K depth for data is always available.

Notes: If an option containing *State* is selected and no channel is defined for an external clock on the Format menu, you are warned of this. You may continue to define state sequences, but you will not be able to *RUN* until you have defined the necessary clock channels.

Triggering and storing are separate activities, therefore, for example, you can trigger on a timing pattern, even if you specify "state only" here, and vice versa.

Effect: Changes data acquired, sequence options available, and default display menu.

Default: Auto.

Trigger Position

Trigger pos:
Begin

TRIGGER POS
Begin
Begin + 25%
Center
End - 25%
End
User-defined ▶

Purpose: Specifies the position of the trigger point in data memory/measurement.

Type: List. Press *SELECT* to get a list (shown at left).

When acquisition is stopped, a certain percent of the memory contains data that was stored before the trigger point, and the rest of memory contains data that was stored after triggering. These are shown in the following table:

Option	Pre-trigger*	Post-trigger
Begin	0%	100%
Begin+25%	25%	75%
Center	50%	50%
End-25%	75%	25%
End	100%	0%
User-defined	------ *as specified* --------	

Note: * The values in this column are *maximum* percentages. The amount of data acquired will depend on how soon the

trigger point is detected after a run is started.

On selecting ***User-defined***, a pop-up menu appears on which you can specify a custom trigger position.

```
☑                USER-DEFINED TRIGGER POSITION
After triggering STATE section:
   Wait      20 ns,
                    then stop STATE acquisition.

After triggering TIMING section:
   Wait      20 ns,then stop TIMING acquisition.
```

There are two independent sections allowing you to set the trigger position for:

- state (shown only if the Data stored field includes state data).
- timing.

Each allows you to set a delay before acquisition of that section is stopped.

The left-most field is a toggle determining which other fields appear.

After Triggering of **STATE** section:

First field: Toggle: Wait/Fill/Count

Wait: 2nd field: integer specifying number of time units.

3rd field: time unit field.

Fill: 2nd field: integer specifying percent of memory to fill.

Count: 2nd field: integer specifying number of clock states to count.

3rd field: pop-up menu if more than 1 clock is defined. Clocks to count are toggled.

After Triggering of **TIMING** section:

First field: Toggle: Wait/Fill

Wait: 2nd field: integer specifying number of time units.

3rd field: time unit field.

Fill: 2nd field: integer specifying percent of memory to fill.

Effect: Changes amount of data stored after triggering.

Default: of Trigger Position menu: Begin

of Special menu: Wait 20 ns.

Run Mode

Run Mode:
Single

Purpose: Determines whether a single or repeating run is required.

Type: Toggle:

Single: The data acquisition runs only once.

Auto-repeat: Data acquisition keeps repeating until stopped by the stop condition specified in the run parameter pop-up menu, or by pressing the *STOP* key.

Effect: Changes run action and whether run parameters can be selected.

Default: Single.

Run Parameters

Runparameters

Purpose: Specifies parameters for repeating runs.

Type: Pop-up menu.

```
☑                    RUNPARAMETERS
Start acquisition every:      5 s
Timing data comparison : Off      ; Skew      5 ns
State data comparison  : Off
```

The fields are:

Start acquisition every: integer specifying the number of seconds to wait before

the run is restarted. (PM 3585: Value specified applies to both analyzers.)

Timing data comparison:
Toggle:

Off: Only *STOP* key stops acquisition.

Equal / Not Equal:
Auto-repeat is stopped if New data acquired matches / does not match the reference data, depending on the following field.

Skew: integer specifying the allowed difference between the New and Ref data for it still to be considered a match.

State data comparison:
Toggle:

Off: Only *STOP* key stops acquisition.

Equal / Not Equal:
Auto-repeat is stopped if New data acquired matches / does not match the reference data.

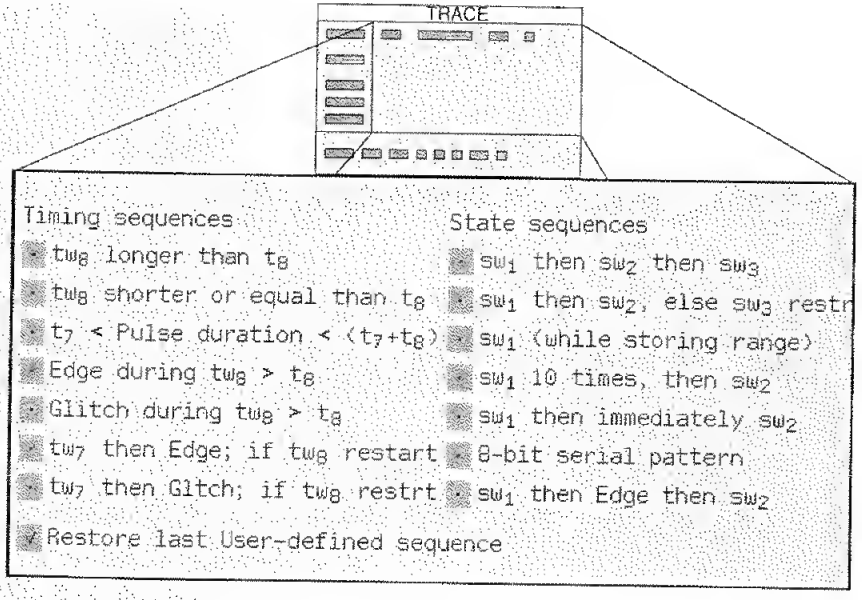
Effect: Changes stop condition of auto-repeat runs.

Default: Auto-repeat every 5 seconds with no comparisons and 5 ns skew.

Data Comparison

Data comparison is performed between R and S cursor positions as last specified while viewing New, Reference or Compare data on the Display menu. R and S cursor positions can be set independently for Analyzer 1 State, Analyzer 1 Timing, PM 3585 Analyzer 2 State, and PM 3585 Analyzer 2 Timing.

Note: If the Display menu is in split-screen mode and both are showing the same type of data from the same Analyzer, then the R and S cursor positions from the last-selected window (i.e., containing the highlighted field) are taken.



In the predefined sequences area, you can specify the sequence of patterns that must be found in the data stream captured before the acquisition of data is triggered and stopped by using one of a set of predefined sequences.

The following applies to all predefined sequences:

If the condition or sequence of conditions is met, the analyzer is triggered and a pulse is sent out to the external BNC connector (Trig out). The acquisition is then stopped in accordance with the trigger position specified in the "Trigger pos" field in the Run Definition area.

For an explanation of the specific conditions, see "Pattern Recognition" beginning on page 35.

Timing Sequences

The trigger sequences in the ***left column***, except the last, use timing conditions only. Each of these sequences is described below by showing its "User-defined" equivalent:

tw_8 longer than t_8.

L_1	If	$(tw_8>t_8)$	1 times, Stop

tw_8 shorter or equal than t_8.

L_1	If	$(tw_8\leq t_8)$	1 times, Stop

t_7 < Pulse duration < $(t_7 + t_8)$.

L_1	If	$(tw_7>t_7)$	1 times, goto L_2
L_2	If	$(tw_8\leq t_8)$	1 times, Stop trigger BNC
	Or If	$(tw_8>t_8)$	1 times, goto L_1

Edge during $tw_8>t_8$.

L_1	If	$(tw_8>t_8)$ · Edge	1 times, Stop trigger BNC

Glitch during $tw_8>t_8$.

L_1	If	$(tw_8>t_8)$ · Glitch	1 times, Stop trigger BNC

tw_7 then Edge; if tw_8 restart.

	If	tw_8,	restart
L_1	If	tw_7	1 times, goto L_2
L_2	If	Edge	1 times, Stop trigger BNC.

tw_7 then Glitch; if tw_8 restart.

	If	tw_8,	restart
L_1	If	tw_7	1 times, goto L_2
L_2	If	Glitch	1 times, Stop trigger BNC.

State Sequences

All the trigger sequences in the ***right column*** except the last use state conditions only. The last sequence in the right column uses a combination of state and timing conditions. Except for the sequence where it is stated otherwise, ("sw_1 (while storing range)") all the state sequences store all state samples until the trigger point.

After triggering, all state samples are stored until acquisition is stopped.

Note that state samples are only stored if the "Data Stored" field in the Run definition area indicates state data storage.

Each of these sequences is described below by showing its "User-defined" equivalent:

sw_1 then sw_2 then sw_3.

	Store	Anystate	
L_1	If	sw_1	1 times, goto L_2
L_2	If	sw_2	1 times, goto L_3
L_3	If	sw_3	1 times, Stop trigger BNC

sw_1 then sw_2, else sw_3 restrt.

	Store	Anystate	
	If	sw_3,	restart
L_1	If	sw_1	1 times, goto L_2
L_2	If	sw_2	1 times, Stop trigger BNC

sw_1 (while storing range).

	Store	Range	
L_1	If	sw_1	1 times, Stop trigger BNC

sw_1 10 times, then sw_2.

	Store	Anystate	
L_1	If	sw_1	10 times, goto L_2
L_2	If	sw_2	1 times, Stop trigger BNC

sw_1 then immediately sw_2.

	Store	Anystate	
L_1	If	sw_{12}	1 times, Stop trigger BNC

8-bit serial pattern.

	Store	Anystate	
L_1	If	sw_1	1 times, goto L_2
	Or If	$\overline{sw_1}$	1 times, goto L_1
L_2	If	sw_2	1 times, goto L_3
	Or If	$\overline{sw_2}$	1 times, goto L_1
...	...	...	...
L_8	If	sw_8	1 times, Stop trigger BNC
	Or If	$\overline{sw_8}$	1 times, goto L_1

sw_1 then Edge then sw_2.

	Store	Anystate	
L_1	If	sw_1	1 times, goto L_2
L_2	If	Edge	1 times, goto L_3
L_3	If	sw_2	1 times, Stop trigger BNC

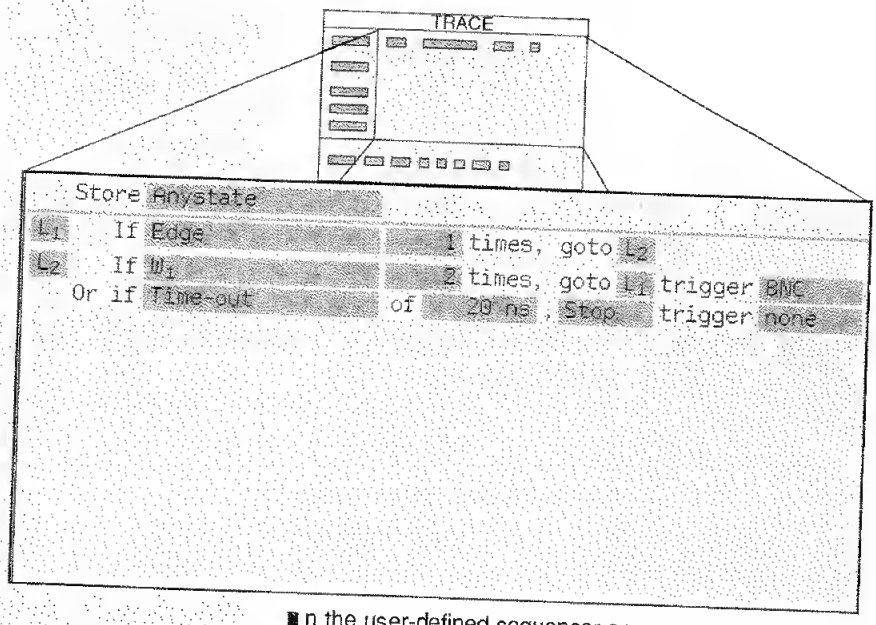
Last User-defined Sequence

Use the last user-defined sequence in preference to one of the predefined sequences.

You may select one of the predefined sequences, then change it as required. To do so, you have to go to the "sequence" field in the Run definition area and select the option "User-defined" in this field. The currently selected Pre-defined sequence is then used as a template for the User-defined sequence. If you previously had a user-defined sequence, this is then replaced by the selected predefined sequence.

On returning from User-defined to predefined sequences, the "Last User-defined sequence" is the default.

One user-defined sequence is always remembered, so you can use a predefined sequence, then come back and use your last user-defined sequence.



In the user-defined sequencer area, you can specify the sequence of patterns that must be found in the data stream captured before the acquisition of data is triggered and stopped.

In addition, if state data is to be stored (as indicated by the *Data stored* field in the Run Definition area), you can specify with each step of the sequence which specific data you want recorded.

Each level can be constructed from any combination of the following conditions:

L_i Store [ ]

After [ ]

If [ ] [ ] times, goto [ ] trigger [ ]

Or if [ ] [ ] times, goto [ ] trigger [ ]

The *Store* option is only present per level if you specify that state data is to be stored, and if you set the global store field to *Per level.*

After and *trigger* are inserted using the Level options pop-up menu. This pop-up menu is obtained by pressing *SELECT* on the level field (L_i at top left).

By using the *After* option, you can suspend the sequencer, pending an external signal or a trigger from the other analyzer (the last for PM3585 only).

By using the *trigger* option, you can trigger the state or timing sections and send a pulse to the other analyzer or external output.

Store Condition Fields

Store Word

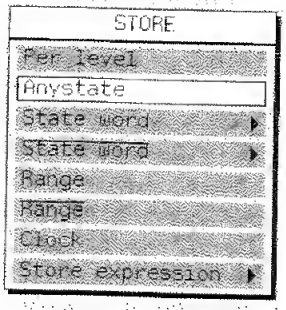
Store Per level

Store Anystate

Purpose: Specifies what state data should be stored. There are two types of store condition:

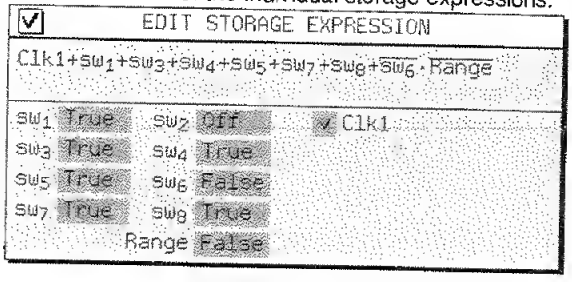
Global Store Condition: specifies what state data should be stored globally, i.e. with any level, before the trigger point. Alternatively, you can define here that the data to be stored is to be specified per level.

Level Store Condition: specifies which specific state data should be stored while the sequencer is at this level.



Type: List: Press *SELECT* to get a list similar to that at left. Note that the first option is *Per Level* on global lists and *Nostate* (i.e., no storage at this level) on level store lists. See also "Pattern Recognition" beginning on page 35.

Store expression: On pressing *SELECT*, the Storage Expression pop-up menu is shown with example settings below. This allows you to define a combination of the individual storage expressions.



The fields on this menu are:

- sw_1 - sw_8: Toggle: ***Off*** / ***True*** / ***False***
- Range: Toggle: ***Off*** / ***True*** / ***False***.
- Clocks: Toggle: • or ✓ (see sidebar on page 51).

Note: If a clock is selected, this means that all samples captured with that clock are stored. This also includes those words sw_i which are valid for this clock and set to "off" in this pop-up menu.

When more than one item is selected from the menu, the chosen items are effectively ***OR***ed together. That is, positive items are *OR*ed; all *NOT* items are *AND*ed together and then *OR*ed with the other items.

Effect: Changes this sequencer area and affects the data stored.

Defaults: Global Store Condition: Anystate
Level Store Condition: Anystate.

Level Number

L_1

Purpose: Shows which level is concerned, acts as a label to branch to, and allows you to select level options.

Type: Pop-up menu. (Press *SELECT* to get Level Options menu shown on the next page.)

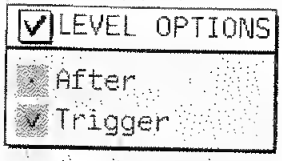
Operation: Depends on the key pressed:

INSERT: causes a new level to be added, up to a maximum of 8. Note that *INSERT* on any field of the level adds an *Or If* row.

DELETE: removes the current level. If only one level is left, you may not remove it: at least one level must remain in the sequencer area.

Check fields:

Pressing *SELECT* toggles between • meaning not selected, and ✔ meaning selected.



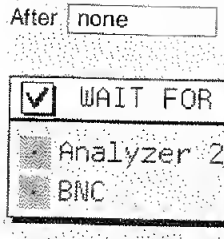
SELECT: causes the Level Options Menu to be shown as at left. This menu contains two check field options (see side-bar on previous page). The options are:

After: if selected, causes the After condition for this level to be available (to suspend the search for the conditions specified at a trigger level until after some external signal is received).

Trigger: if selected, causes the trigger condition for this level to be available.

Defaults: No trigger selected.

After Condition



Purpose: Specifies whether the sequence must be suspended until either the other analyzer or the BNC has provided a signal.

Type: Pop-up menu: Pressing *SELECT* causes the Wait for Menu to be shown as at left. This menu contains two (PM 3585) or one (PM 3580) check field options (see sidebar on page 51). The options are:

Analyzer 2: (Not PM 3580. The field name changes as appropriate.) If selected, causes the current analyzer to wait for a trigger signal from the other. The other analyzer can be programmed to generate a trigger pulse for this analyzer at any level by using the Trigger field as appropriate.

BNC: if selected, causes the analyzer to wait for an external trigger signal from the BNC.

Note: Data storage is ***not*** suspended during the wait period.

Defaults: None.

If / Or if / Restart Conditions

If [Wait forever]
Or if [Wait forever]

Purpose: Specifies the pattern or patterns that must occur to go to the specified level in the sequence (If and Or If) or to restart the sequence (restart).

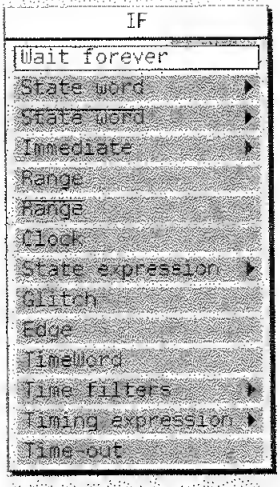
Notes: The *If* condition has higher priority than the *Or If* and *Restart* conditions.

The *Or If* line is inserted by pressing *INSERT* on any field of the if line.

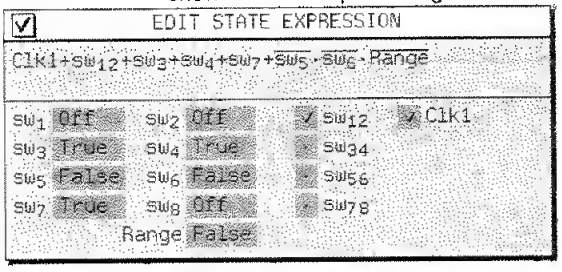
The *Or If* line can be deleted by pressing the *DELETE* key while on one of the fields of the *Or If* line.

Note that the *Or If* line cannot be inserted per level, if the sequence is of type *Restart*.

Type: List. (Press *SELECT* to get the list shown at the left. Options are described in "Pattern Recognition" beginning on page 35, except:



State expression: When you press *SELECT*, the State Expression pop-up menu is shown with example settings below.



This allows you to define a combination of the single state elements for state comparison.

The fields on this menu are:

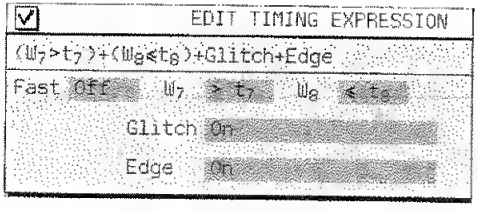
- sw_1 - sw_8: Toggle: ***Off*** / ***True*** / ***False.***
- Range: Toggle: ***Off*** / ***True*** / ***False.***
- Clocks: Toggle: • or ✓.
- Immediate:
  (sw_{12} - sw_{78}): Toggle: • or ✓.

Note: If a clock is selected, this means that all samples captured with that clock are stored. This also includes those words sw_i which are valid for this clock and set to "off" in this pop-up menu.

When more than one item is selected from the menu, the chosen items are effectively *OR*ed together. That is, positive items are *OR*ed; all *NOT* items are *AND*ed together and then *OR*ed with the other items.

Defaults: Wait forever.

Timing expression: When you press *SELECT*, the Edit Timing Expression pop-up menu is shown with example settings below.



This allows you to define a combination of the single timing elements for timing comparison.

The options on the menu are:

TimeWord: Toggle: ***On / Off***.

tw7, tw8: Toggle: ***Off / On*** / $\leq t_i$ / $> t_i$.

Glitch, Edge: Toggle:
Off / On /
During (tw_7>) /
During (tw_8>) /
During (tw_7> or tw_8>) .

Default: Wait forever.

Time-out: (not restart) Allows a branch to be performed after a certain amount of delay.

When you select time-out, the times expression (shown in the next section), changes to the field shown at left. The time-out value field is real numeric, 40 through 65520 ns in steps of 20 ns.

Default: 40 ns

of 1 ns

Times

1 times,

Purpose: Specifies the number of times that the condition should occur before the branch takes place.

Type: Integer numeric 1-65535. (Calculator style field, only numbers accepted.)

Note: A maximum of four of these fields may be set to a value other than 1. (This includes the time-out value fields.)

This field is ignored if the condition is a timing word or timing expression.

Default: 1.

Goto

goto L1

Purpose: Specifies the level to go to after the condition was found the specified number of times.

Type: First character select. Press *SELECT* to get a list with labels L_1 through L_8 plus Stop. Selection can also be made by pressing 1 through 8 or S.

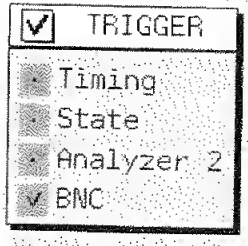
Operation: When you select Stop, the text and field as shown at left are changed to the single field *Stop*, and vice versa. Also when you select *Stop* the timing and state sections are implicitly stopped so that the trigger option is not needed for them.

On insertion or deletion of a level, goto automatically changes so that it still points to the same place.

Defaults: The default for the last level defined is *Stop*.

Trigger

trigger none



Purpose: Specifies which *units* must be triggered when the *If* or *Or If* condition was found the specified number of times.

Type: Pop-up menu: Pressing *SELECT* causes the Trigger Menu to be shown as at left. This menu contains four check field options (see sidebar on page 51). These options are:

Timing: Causes the sequencer to stop the acquisition of timing data.

State: Causes the sequencer to stop the acquisition of state data.

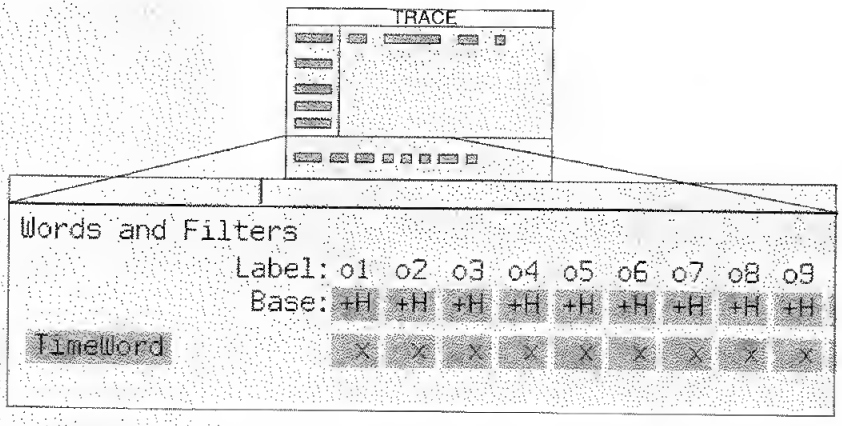
Analyzer 2: (PM 3585 only. The field name changes as appropriate) if selected, causes the current analyzer to signal

the other. The other analyzer can be programmed to wait for this signal at any level by using the After condition as appropriate.

BNC: causes a trigger pulse to be output on the BNC connector.

Note: When *Stop* is selected in the goto field, the timing and state sections are implicitly triggered.

Default: BNC.



The trigger words area contains the definitions of the words, ranges, etc. used in the sequencer area.

As pre-defined sequences are selected or conditions are specified in the user-defined or restart menus in the Store, If and Or if fields, the appropriate definition fields are added to this area. You can then move to this area, and modify the settings as required. You can also insert and delete words in this area manually.

Generally, the default settings are x's, meaning "don't care" (ignore).

On start-up, only the TimeWord is defined.

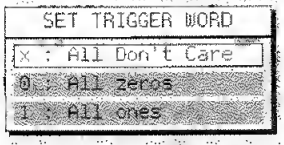
The TimeWord is sampled at 5 ns intervals on PM 3585 units and at 10 ns intervals on PM 3580 units. All other timing words are sampled at 20ns intervals. Glitches and edges are found immediately. State words are sampled at the rate of the external clock.

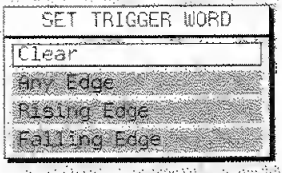
The trace menu and choice of sequences are described fully in the *PM 3580/PM 3585 User Manual*. For an explanation of the patterns, see the section "Pattern Recognition" beginning on page 35.

On the following pages, each of the items that can appear in the Trigger Words area is described.

Trigger Word Name

TimeWord





Purpose: Labels the word pattern defined in this area.

Type: First character selection. The characters accepted or the list shown when you press *SELECT* depend on the type of trigger word. The options allow you to set all labels associated with this trigger word to a common value.

For Words or TimeWord:

SELECT: causes the list at left to be shown.

- **x:** equivalent to list ***All Don't Care:*** (Set all to ignore) causes all values to be set to x. This means the channels are not considered during the matching of data samples. Individual channels can be set to other values, as described below.
- **0:** equivalent to list ***All zeros.*** Sets all values to zero.
- **1:** equivalent to list ***All ones:*** sets all values to 1.

For Glitch:

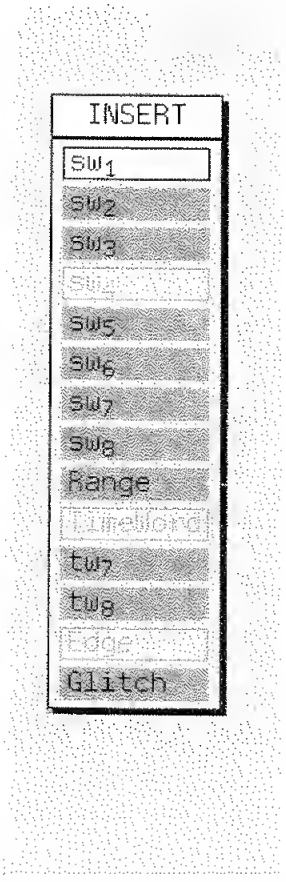
SELECT: causes a list with clear all and set all options shown.

- **C:** clear all settings
- **S:** set all channels.

For Edge:

SELECT: causes the list at left to be shown.

- **C:** clear all settings
- **A:** set all channels to Any edge.
- **R:** set all channels to Rising edge.
- **F:** set all channels to Falling edge.



For Range:

SELECT causes a list with clear all option shown. Selection or **C** has the same effect, that is setting all to x's.

For Glitch and Edge the base is automatically changed to binary to allow entry on individual channels.

Operation: Depends on key pressed and type of trigger word:

***SELECT or letter** – as described above.*

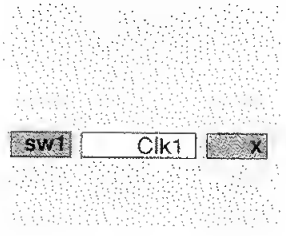
INSERT: Causes a list, as the example at left, to be shown. This list shows those words which are already defined in the trigger words area as unselectable (light gray).

Note that when you choose Range, both Range high and low are inserted.

DELETE: Causes the current item to be deleted. If only one trigger word is left, you may not remove it: at least one trigger word must remain in the trigger words area. Range high and range low are counted as one word for deletion.

Default: TimeWord. Words are added according to options in the sequence area. All words are added with all values set to x. Inserted glitch and edge words are set to not selected.

Clock Used / Filter Time



Purpose: Specifies which external clock is used for sampling a state word, or the filter time for a timing word.

Type: List/Numeric (see *Operation* below).

Operation: Depends on the key pressed:

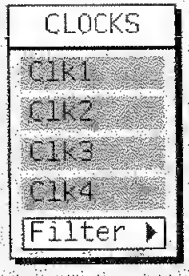
INSERT and ***DELETE:*** Same as for "Trigger Word Name" on page 59.

numeric key: if the Trigger word is any of sw_7, sw_8, tw_7, or tw_8, this causes a numeric entry pop-up menu to be shown, where you can specify the filter time. Note that if sw_7 or sw_8 is given a filter time, it changes into the associated timing word tw_7 or tw_8.

SELECT: Depends on the keyword:

sw_1 - sw_6, range: A list of available clocks is shown, or if less than two defined, a warning is given.

sw_7, sw_8, tw_7, tw_8: A list showing all available external clocks and *Filter* ▶ as at left. If there are no clocks defined, the default Clk1 is nevertheless shown. Note that timing words tw_7 or tw_8 are changed to state words sw_7 or sw_8 if a clock is selected, and vice versa if a filter is selected.



Selecting a **clock**, causes that clock, (signal, edge, and qualifier expression defined on the Format menu) to be used as the time when the match is done.

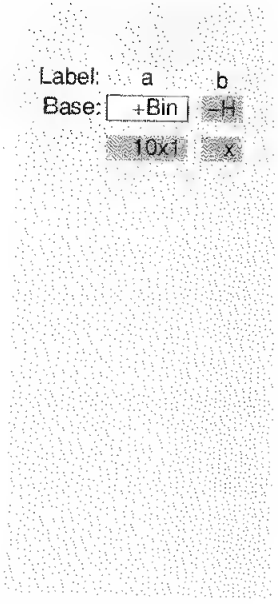
On ***Filter*** causes the numeric pop-up menu to appear, as numeric entry.

Note that specifying the filter time for the word causes the word to be filtered only if the filter is used in the *If* condition.

The filter time can be specified in a range from 20 ns to 1.31 ms (2^{16} x 20 ns) in steps of 20 ns.

Effect: Changes when state data words are matched or the filter time of timing words.

Base



Purpose: Specifies the number base in which the label's values are shown.

Type: First character select. Press the key for the initial character of one of the following, or press *SELECT* for a menu of:

Binary, Octal, Decimal,Hexadecimal or Ascii.

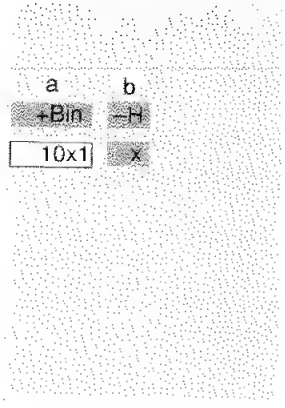
Notes: The base is shown as two characters when the associated pattern definition (below) is two or less characters wide, and as four characters otherwise. The character used is the first character of the base name (B, O, D, H or A).

The + or – character reflects the polarity of the signal set on the Format menu. It is for information only and cannot be changed here.

Effect: Changes display of trigger patterns in its column in this area only.

Default: Hexadecimal.

Pattern Fields



Purpose: Specify word patterns to compare with sampled data.

Type: Editable. (Type in the new value.)

Operation: Depends on the key pressed:

INSERT and ***DELETE:*** same as for "Trigger Word Name" on page 59.

alphanumeric: If the character is within the range of the current base and there are sufficient bits to represent the number, it is shown.

If the character or characters entered are within range, but the resulting number cannot be represented in the number of bits available, then the number is *chopped*. That is, the excess MSBs are removed, and the resulting number and a warning are shown.

For example, entering *B* in a single channel Hex field, causes a 1 to appear there.

If the entered character is not valid for the base (e.g., not 1 or 0 on a binary field), then an error message is shown, and you cannot leave the field until a valid character is input.

An important exception to this is the *don't care* character *x*, which may be entered in any position of any field to indicate that the position should be ignored.

Ascii base characters cannot be altered directly, but may be, in another base. Changing back to Ascii causes values 21 hex through 7E hex to be shown as [c] where c is the represented character. Other values are shown in octal.

Note: Label's channels show a '?' sign for values that cannot be represented in the currently-selected base.

Default: 'Don't care' value (x).

I/O

Input/Output Menu

Menu Access

The Input/Output (I/O) Menu can be accessed at any time by pressing the I/O key.

Menu Purpose

This menu allows settings and reference data to be recovered from or saved to floppy disk and to perform operations on files and disks. Furthermore, the autoload file can be defined using this menu.

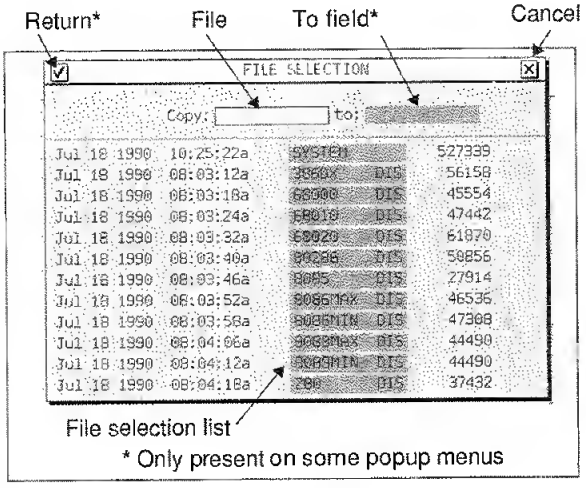
```
I/O                                                    Jan  1 1990 07:38p
Load:     MEAS                    Copy                                Format
Save:     MEAS                    Rename
Autoload: MEAS.AUT                Delete

LABEL:                                   FREE:  830464
DATE          TIME          FILENAME            SIZE
Jan  1 1990   10:00:20a     SYSTEM            527339
Jan  1 1990   12:00:10p     DEMODISA DIS       45554
Jan  1 1990   06:00:18p     TIMING   NEW        8490
Jan  1 1990   06:00:18p     TIMETRIG NEW        8348
Jan  1 1990   06:00:18p     STATE    NEW       11568
Jan  1 1990   06:00:18p     DEMODISA NEW       24580
```

The I/O menu has two areas: the command area at the top of the screen, and the file list below.

If there are more files on disk than can be shown, a vertical bar with a display locator (hollow rectangle) is shown at the right of the file list. The position of the display locator indicates which part of the total list of files is currently displayed.

I/O Popup Menus

The pop-up menus on the I/O menu are similar. An example is shown below.



Operation (except copying and renaming):

Highlight the *File* field. Either type in the name of the required file or use the arrow keys to move the highlight to the file required in the file selection list. As the highlight changes, the file name changes in the *File* field.

Press *SELECT* to accept the name. Select the *Return* field to perform the action and close the popup menu.

To cancel the action and close the pop-up, select the *Cancel* field.

Operation (copying and renaming):

Highlight the *File* field and select the name as above. The *SELECT* key "fixes" the name in the *File* field.

Highlight the *To* field, and proceed as for the *File* field. You can then change the file name in either field by using the alphanumeric keys.

To close the pop-up menu and perform the selected action, select the *Return* field.

To cancel the action and close the pop-up, select the *Cancel* field.

Load New and Settings

Load: MEAS

Purpose: Causes the selected data file to be loaded as the new data values in place of the last acquired data, and to set up the analyzers.

Type: Pop-up menu.

Operation: See "I/O popup Menus" beginning on page 67.

Selecting the *Return* field causes the data for the current measurement and the settings for ***both*** analyzers to be loaded.

Data is all the information related to an acquisition directly, thus the samples, status information, etc.

Settings are all the information not directly related to an acquisition, thus label and sequencer settings.

If the settings contain one or two disassemblers, and the disassemblers cannot be loaded from the current floppy disk, you are asked to insert the floppy disk containing the disassembler load file or files.

Effect: Changes new data values.

Default: Filename MEAS.

Save New and Settings

Save: MEAS

Purpose: Saves the new (current) measurement data and settings in a file for subsequent reloading.

Type: Pop-up menu.

Operation: See "I/O popup Menus" beginning on page 67.

Effect: Changes data stored on disk.

Default: Filename MEAS.

Define Autoload

Autoload: MEAS.AUT

Purpose: Defines the name of the file that will be automatically loaded the next time the instrument is powered up.

Type: Popup menu.

Operation: See "I/O popup Menus" beginning on page 67. If the name is not MEAS.AUT, you are prompted to copy the file to MEAS.AUT or to rename the autostart file.

Effect: The file MEAS.AUT if it exists on the start-up disk is automatically loaded on power up.

Default: Filename MEAS.AUT.

Copy File

Disk utilities:

Copy

Rename

Delete

Format

Purpose: Allows a file to be copied to the current disk.

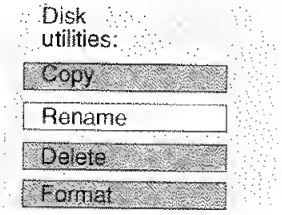
Type: Popup menu.

Operation: See "I/O popup Menus" beginning on page 67.

Effect: Copies one file to another on the floppy disk.

Default: None.

Rename File



Purpose: Changes the name of a file on the current disk.

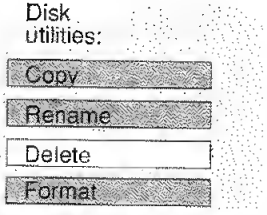
Type: Pop-up menu.

Operation: See "I/O popup Menus" beginning on page 67.

Effect: Renames the file on the current floppy disk.

Default: None.

Delete File



Purpose: Deletes a file on the current disk.

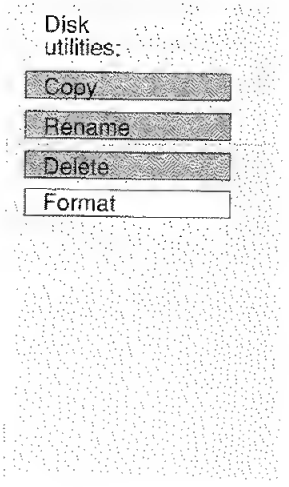
Type: Pop-up menu.

Operation: See "I/O popup Menus" beginning on page 67.

Effect: Deletes one file on the current floppy disk.

Default: None.

Format Disk



Purpose: Used to initialize a new floppy disk.

Type: Pop-up menu.

Operation: You are prompted if you want to do this.

Effect: Formatting a disk which already has data on it will destroy all that data.

Default: None.

DISPLAY

Timing Display

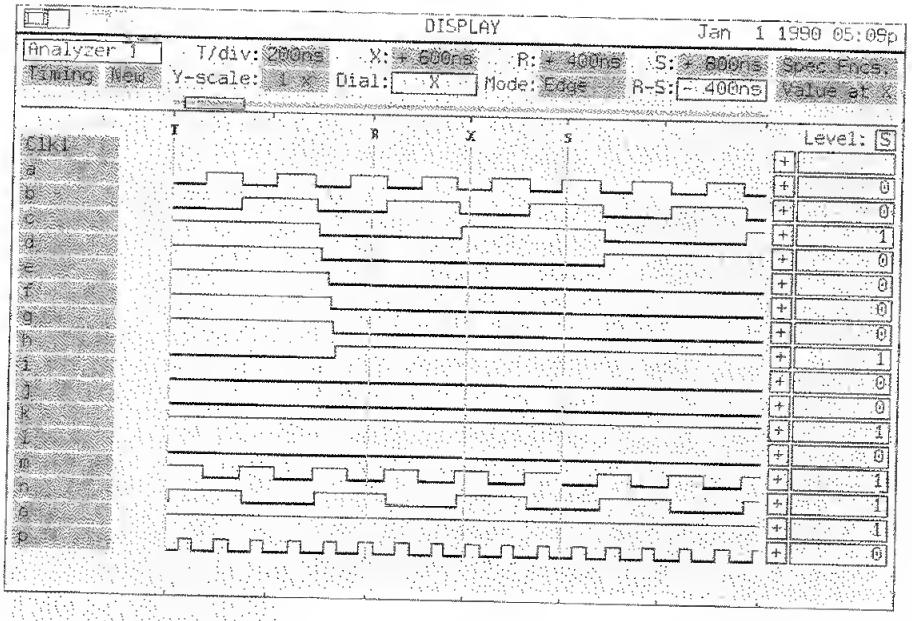
Menu Access

The display menu can be accessed at any time by pressing the *DISPLAY* key.

Menu Purpose

The display menu shows the results of an acquisition. Depending on the type of data acquired, the data is shown as either a timing or a state display (shown in "State Display" beginning on page 85). The type of data acquired (see section "Type of Data Stored" on page 39) determines the default display format. Subsequently the last displayed format is shown.

The screen consists of one or two equally-sized display windows (split screen).



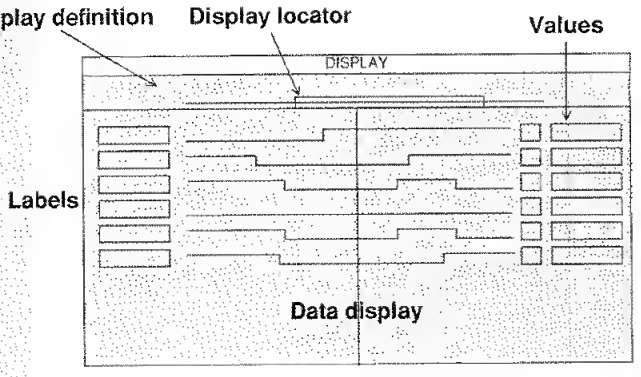
The Waveform display consists of four areas (Also see the diagram on the following page):

The ***display definition*** at the top gives you information about the current display, allows you to selectively move through the display, and lets you change aspects of the display.

The ***labels*** on the left-hand side show the labels you defined in the Format menu. The signal in the data area, and the value in the value area to the right of the label, correspond to the signal (bus or channel) you set up.

The ***values*** on the right-hand side show the polarity set on the Format menu and the value of the signal. The value is shown at the position defined by the Displayed value field, above this column in the display definition area. The values can be displayed at the X, R, S, or Trigger position.

The ***data display*** in the center of the screen shows the timing trace for each of the signals shown on the left.



The horizontal line dividing the two parts of the display area is a scale marked in six divisions. Each division represents the time interval length set in the T/Div field. That is, if T/Div shows 100ns, then one division is 100ns.

When the highlight is on one of the fields T/Div, X, R or S, the value of that field can be changed by turning the dial. When on any other field, the dial retains the use to which it was last put.

The Timing fields on the display are described below.

Analyzer Name

Analyzer 1

Purpose: Shows from which analyzer the data displayed originates.

Type: PM 3585: Toggle: Analyzer 1 / Analyzer 2.
PM 3580: Special (see *Operation* below)

Operation: Depends on the key pressed:

SELECT: (PM 3585 only) By selecting this field you switch between the display of the signals associated with Analyzer 1 and those of Analyzer 2. If only one analyzer is active, this option is not available.

INSERT: Causes a single window display to become a double window, and the cursor to be moved to the new window. Initially the contents of the second window are determined by the type of data acquired (see "Type of Data Stored" on page 39.).

DISPLAY: If two windows are shown, this key can be used to switch between them.

DELETE: When two windows are displayed, pressing the *DELETE* key on the analyzer name field of one window causes that window to be deleted.

Effect: Changes the displayed screen.

Time per Division

T/Div: 50ns

Purpose: Selects the scale of the time axis on the display. Shows the time interval represented by each of the six divisions below the display definition area.

Type: Pop-up menu (Real numeric, calculator style field where you may only enter real numbers.)

Operation: The pop-up menu appears if you press *SELECT* or a numeric key.

You may enter any value here (see the section on the general use of numeric fields in "Field Types" on page 4), but the value set is rounded to one of the divisions that can be set as shown in the side-bar below. You may also use the dial to change the time per division when this field is highlighted. Turning the dial clockwise decreases the time per division (thus expands the display), and vice versa.

The display locator (the hollow rectangle) shows the resulting scale of the displayed data relative to the acquired data.

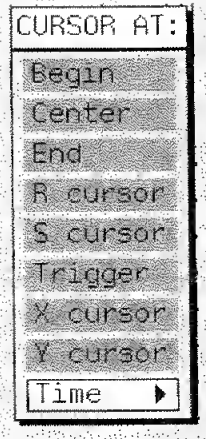
Scale Divisions:

5ns, 10ns, 20ns, 50ns, 100ns, 200ns, 400ns, 800ns, 2us, 4us, 10us, 50us, 100us, 200us, 500us, and so on with values 1, 2, 5, 10, 20, 50, 100, 200, 500 in ms, s and ks (kilo-seconds) through 50ks.

Effect: Changes the presentation of the display. Use of the dial locks Dial field to T/Div, and changes Mode field to Step.

Default: 10% of the total timing data captured, rounded to one of the valid scale divisions.

X Position



Purpose: The X position defines the time of the data in the middle of the timing display (the X cursor). This field shows this time, relative to T_0, and allows it to be changed to view another section of the data.

Type: First character select/Pop-up menu (See Operation below.)

Operation: Pressing *SELECT* shows a list as at left. You may also press the first character of any one of the options, except Time, to have the same effect. (I.e., *B, C, E, R, S, T, X* or *Y*.) If you select Time from the list, or press a numeric key on the field, a real numeric pop-up is shown.

You may also use the dial to change the X position. The display locator (the hollow rectangle) shows the resulting position of the displayed data relative to the acquired data.

Effect: Changes the center point of the display. Use of the dial locks Dial field to X, and if T/Div was used last, it changes Mode field to that last selected for X, R or S (originally Edge).

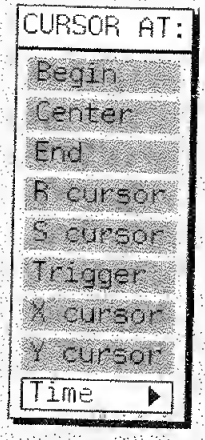
Default: 0 sec, thus at T_0. T_0 is the oldest sample in the data, or the oldest trigger point. This is described further in the sidebar on page 98.

This guarantees that the time information for all analyzers has the same reference.

After a new measurement, the value remains the same.

R and S Positions

R: + 0ns S: + 0ns



Purpose: These two fields show the positions of the R and S cursors relative to T_0 and allow them to be set.

Type: First character select/Pop-up menu (See Operation below.)

Operation: Pressing *SELECT* shows a list as at left. You may also press the first character of any one of options, except Time, to have the same effect. (I.e., *B, C, E, R, S, T, X* or *Y*.) If you select Time from the list, or press a numeric key on the field, a real numeric pop-up is shown. You may also use the dial to change the cursor position.

Effect: Changes the position of the R or S cursor, as appropriate and the value in the R-S field. Use of the dial locks Dial field to R or S respectively, and if T/Div was used last, it changes the Mode field to that last selected for X, R or S (originally Edge).

Notes: The positions of the R and S cursors are freely definable. Setting these values does not move the display.

Default: R at minus 1 division, S at plus 1 division from T_0. (See sidebar on page 98 about T_0.) One division is 10% of the total timing data captured, rounded to one of the valid scale divisions.

Display Special Functions

Spec.Fncs.

Purpose: To show the Display Special Functions Menu. This allows special functions for the display to be controlled, and shows how the memory is used in storing data.

Type: Popup menu. (Press *SELECT* to show the "Display Special Functions Menu" as described beginning on page 97.)

Effect: Changes display presentation and reference data.

Default: No special functions selected.

State/Timing

Timing

Purpose: This field selects which type of acquisition data is shown.

Type: Toggle (also first character select): *Timing / State.*

Effect: Changes type of display.

Default: Depends on the data acquired. If the data is State only, the default is state; otherwise the default is Timing.

Data Source

New

Purpose: This field determines the source of data to be displayed.

Type: First character select. Press the key of the initial letter of the following (i.e., *N*, *R* or *C*) or press *SELECT* to get a list of:

New: Newly acquired data.

Reference: Reference data. Shown as *Ref.*

Compare: Comparison of New and Reference data, shown using the exclusive-OR function. Differences between New and Reference are then displayed as *high* (1), and equalities as *low* (0).

Effect: Changes information displayed.

Default: New.

Y Scale

Y-scale: 1 x

Purpose: This field determines the scaling of the Y axis.

Type: First character select. Numbers 1x through 9x. Press *SELECT* for a list, or press a number key to change the scale.

Effect: Changes appearance of display.

Default: 1.

Dial Operation

Dial: X

Purpose: Shows what the dial does.

Type: Information. The Dial field shows the current use of the dial, depending on which field the dial was last used.

Operation: To change the dial field, highlight one of the following fields and move the dial:

T/Div: The dial increases and decreases the time per division.

R: The dial moves the R cursor.

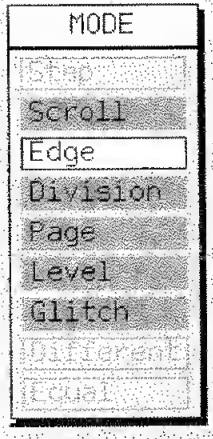
S: The dial moves the S cursor.

X: The dial moves the displayed values relative to the center of the display, the X cursor.

Default: X cursor.

Mode

Mode: Scroll



Purpose: Selects how the dial moves.

Type: First character select. Press the key of the initial letter of the following, or press *SELECT* to get a list of:

Step Only with T/Div. Moves the Time per division one unit (see sidebar on page 75 for the units).

Scroll The movement depends on the speed the dial is moved. The smallest movement is one pixel per "click".

Edge Moves the marker from one edge to the next in the direction the dial is turned. If a signal is highlighted, then the dial moves the marker from edge to edge of that signal only. If any other field is highlighted, the dial moves the marker to the edge of any signal displayed.

Division Moves by one scale division in the turning direction per "click".

Page Moves one display page per "click".

Level Moves the marker to the next (previous) sequence level transition.

Glitch Moves the marker from one glitch to the next in the direction the dial is turned. If a signal is highlighted, then the dial moves the marker from glitch to glitch on that signal only. If any other field is highlighted, the dial moves the marker to the next glitch on any signal displayed.

Different Only when Data Source field is *Compare*. Moves the marker from one

difference between new and reference data to the next in the direction the dial is turned. If a signal is highlighted, then the dial moves the marker from difference to difference in that signal only. If any other field is highlighted, the dial moves the marker to the next difference in any signal displayed.

Equal Only when Data Source field is *Compare*. Moves the marker from one equality of new and reference data to the next in the direction the dial is turned. If a signal is highlighted, then the dial moves the marker from equality to equality in that signal only. If any other field is highlighted, the dial moves the marker to the next equality in any signal displayed.

Effect: Changes effect of the dial.

Default: For T/Div: Step.
For X, R and S: Edge.

Cursor Difference R-S

R-S: -2314 ns

Purpose: Shows the difference between the position of the R and S cursors.

Type: Information.

Displayed Value

Value at X

Purpose: Determines the location for which the value is shown in the values area.

Type: First character select. Press the key of the initial letter of the following (i.e., R, S, T, X or A), or press *SELECT* to get a list of:

R cursor:
No matter where the highlighted field is, the value fields show the value at the position of the R cursor.

S cursor: As for R, but for the S cursor.

T cursor: As for R, but for the trigger position.

X cursor: As for R, but for the X cursor.

Auto: As for R, but for the cursor operated on by the dial.

Effect: Changes data shown in the value fields.

Default: Auto.

Label Name

a

Purpose: Labels the signal and allows the signal to be replaced, a new signal to be inserted or the current signal to be deleted. Also allows dial operation in Edge, Glitch, Different and Equal modes for this signal only.

Type: First character select. Press the key of the initial letter of a label, or press *SELECT* to get a list of labels (as defined on the format menu).

Operation: Depends on the key pressed:

alphanumeric keys:
Replaces the current signal by the next signal starting with the character pressed.

SELECT:
The Waveform Label Replacement popup menu appears showing all the available signal labels, with the current label highlighted. Highlight the required label and press *SELECT* to replace the signal.

DELETE:

When on this field, you can delete this signal from the display. At least one signal must remain on the display.

INSERT:

The Waveform Label Insertion popup menu appears showing all the available signal labels, with the current label highlighted. Highlight the required label and press *SELECT* to insert that signal below the current signal.

When you insert a signal from a bus already displayed, the next channel on the bus is inserted. Insertion cycles from channel 0 through the most significant bit to Bus.

Default: All labels defined on the Format menu are shown (or are present if there are more than can be shown) in the order defined. Busses are shown as one item.

Bus Fields

a Bus

Purpose To show which signals of a bus are being displayed.

Type: Toggle: *Bus / 0 / 1* ... up to the highest numbered bit on the bus.

Operation: The *SELECT* key toggles to the next value. The +/- key toggles to the previous value in this sequence. The *A* key causes *Bus* to be shown and all signals of the bus to be displayed.

Pressing one or more numeric keys corresponding to the number of a bit on the bus causes only that signal to be displayed. If the second key makes a number higher than the highest channel, and the second number is a valid channel, that is the channel displayed. For example in a bus 0 ..12, 1 then 2 shows channel 12, 1 then 4 shows channel 4.

The *INSERT* and *DELETE* keys operate as for Label name fields.

Affects: Display of this signal line and data area.

Level

S

Purpose: Shows the level which the sequencer was at when the sample was captured.

Type: Information only.

Note: 'S' in this field indicates that the samples were captured after the trigger.

Polarity Fields

+

Purpose: Shows the polarity (+ or -) of the signal as set on the Format menu.

Type: Information only.

Value Fields

0

Purpose: Shows the value under the cursor. Which cursor is determined by the Displayed Value field.

Type: Information only.

Note: The value is always shown in Hexadecimal.

DISPLAY

State Display

Menu Access

The display menu can be accessed at any time by pressing the *DISPLAY* key.

Menu Purpose

The display menu shows the results of an acquisition. Depending on the type of data acquired, the data is shown as either a state or a timing display (shown in "Timing Display" beginning on page 71). The type of data acquired (see section "Type of Data Stored" on page 39) determines the default display format. Subsequently the last displayed format is shown.

The screen consists of one or two equally-sized display windows (split screen).

DISPLAY Jan 1 1990 06:08p

Analyzer 1 Disa: None Y: 0002 R: 0000 S: 0004 Spec. Fncs.
State New Dial: Y Mode: Line R-S: -290ns

	Label:	Time	clock in	o1	o2	o3	o4	o5	o6	o7	o8	o9	o10	o11	o12
	Base:	Abs		+H	+H	+H	+H	+H	+H	+H	+H	+H	+H	+H	+H
	-0006	- 435ns	v	1	0	0	1	1	1	1	1	1	1	1	1
	-0005	- 360ns	v	0	1	0	1	1	1	1	1	1	1	1	1
	-0004	- 290ns	v	1	1	0	1	1	1	1	1	1	1	1	1
	-0003	- 215ns	v	0	0	1	1	1	1	1	1	1	1	1	1
	-0002	- 145ns	v	1	0	1	1	1	1	1	1	1	1	1	1
	-0001	- 70ns	v	0	1	1	1	1	1	1	1	1	1	1	1
R	0000	+ 0ns	v	1	1	1	1	1	1	1	1	1	1	1	1
	0001	+ 75ns	v	0	0	0	0	0	0	0	0	1	1	1	1
Y	0002	+ 145ns	v	1	0	0	0	0	0	0	0	0	0	0	0
	0003	+ 220ns	v	0	1	0	0	0	0	0	0	0	0	0	0
S	0004	+ 290ns	v	1	1	0	0	0	0	0	0	0	0	0	0
	0005	+ 365ns	v	0	0	1	0	0	0	0	0	0	0	0	0
	0006	+ 435ns	v	1	0	1	0	0	0	0	0	0	0	0	0
	0007	+ 510ns	v	0	1	1	0	0	0	0	0	0	0	0	0
	0008	+ 580ns	v	1	1	1	0	0	0	0	0	0	0	0	0
	0009	+ 655ns	v	0	0	0	1	0	0	0	0	0	0	0	0
	0010	+ 725ns	v	1	0	0	1	0	0	0	0	0	0	0	0
	0011	+ 800ns	v	0	1	0	1	0	0	0	0	0	0	0	0

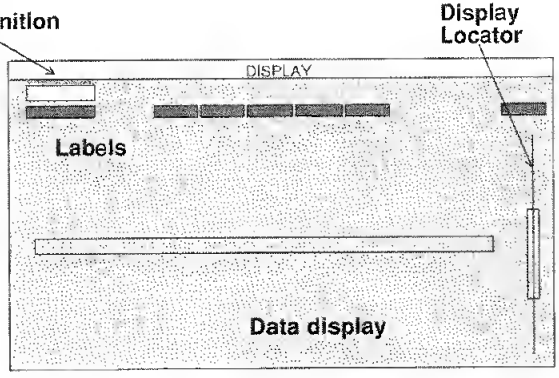
The State List Display consists of three areas, as shown below. These are:

The ***display definition*** at the top gives you information about the current display, allows you to selectively move through the display, and lets you change aspects of the display.

The ***labels*** below that are the labels you defined on the Format menu. The data in the column below a label relates to that label.

The ***data display*** in the center of the screen consists of a column of sample numbers on the left, then a series of data columns to the right of this. On the far right is a vertical display locator, showing the current location, similar to the (horizontal) display locator on the waveform display.

The fields on the display are described below.



Analyzer Name

ANALYZER 1

Purpose: Shows from which analyzer the data displayed originates.

Type: PM 3585: Toggle: Analyzer 1 / Analyzer 2.
PM 3580: Special (see Operation).

Operation: Depends on the key pressed:

SELECT: (PM 3585 only) By selecting this field you switch between the display of the signals associated with Analyzer 1 and those of Analyzer 2. If only one analyzer is active, this option is not available.

INSERT: Causes a single window display to become a double window, and the cursor to be moved to the new window. Initially the contents of the second window are determined by the type of data acquired (see section "Type of Data Stored" on page 39).

DISPLAY: If two windows are shown, this key can be used to switch between them.

DELETE: when two windows are displayed, pressing the *DELETE* key on the analyzer name field of one window causes that window to be deleted.

Effect: Changes the displayed screen.

Disassembler Switch

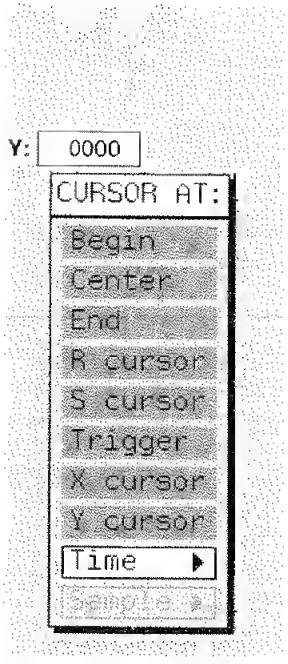
Disa: None

Purpose: Switch disassembly on and off.

Type: If disassembler loaded: Toggle: *On / Off.*
Otherwise: Information showing *None.*

Default: If disassembler loaded: *On.*
Otherwise: *None.*

Y Position



Purpose: Shows the sample number or time (depending on settings in the special functions menu) at the position of the Y cursor (positioned in the middle of the screen) relative to T_0, and allows it to be set.

Type: First character select/Pop-up menu (See Operation below).

Operation: Pressing *SELECT* shows a list as at left. You may also press the first character of any one of the options, except Time and Sample, to have the same effect. (I.e., B, C, E, R, S, T, X, or Y.) If you select Time or Sample from the list, or press a numeric key on the field, a real numeric popup is shown.

You may also use the dial to change the Y position. The display locator shows the resulting position of the displayed data relative to the acquired data.

Effect: Changes the center point of the display. Use of the dial locks Dial field to Y.

If the field shows sample numbers (default – set by the "Display Special Functions Menu" beginning on page 97) then a new sample number can be gone to by typing in the new number. If you press *SELECT*, then a popup menu appears where you can enter the new time.

If the field shows time, then the new time can be entered by either method.

Default: If there is sampled data: sample number 0.

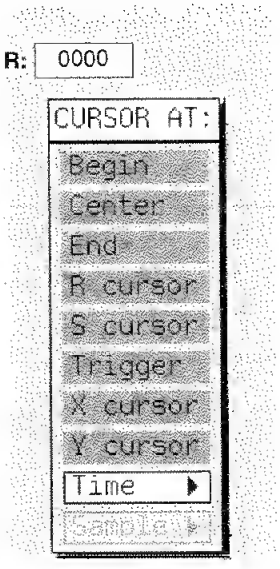
Otherwise: 0 ns.

This position is at T_0, which is the oldest sample in the data, or the oldest trigger point. This is described further in the sidebar on page 98.

This guarantees that all time information of all analyzers is consistent.

After a new measurement, the value remains the same.

R and S Positions



Purpose: Shows the positions of the R and S reference cursors (sample number or time) relative to T_0 and allows them to be set.

Type: First character select/Pop-up menu (See Operation below).

Operation: Pressing *SELECT* shows a list as at left (next page). You may also press the first character of any one of the options, except Time or Sample, to have the same effect. (I.e., B, C, E, R, S, T, X, or Y.) If you select Time or Sample from the list, or press a numeric key on the field, a real numeric popup is shown. You may also use the dial to change the cursor position.

Effect: Changes the position of the R or S cursor as appropriate, and the value in the R-S field. Use of the dial locks Dial field to R or S respectively.

Notes: The position of the R and S cursors are freely definable. Setting these values does not move the display.

The R and S fields can be changed in the same way as the Y Position field: see the previous item.

Default: R at minus 1 division, S at plus 1 division from T_0. (See sidebar on page 98 about T_0.) One division is 10% of the total data captured, rounded to one of the valid scale divisions.

Display Special Functions

Spec.Fcns

Purpose: Shows the Display Special Functions Menu. This menu allows special functions for the display to be controlled and shows how the memory is used in storing data.

Type: Pop-up menu. (Press *SELECT* to show the menu in "Display Special Functions Menu" beginning on page 97.)

Effect: Changes display presentation and reference data.

Default: No special functions selected.

State/Timing

State

Purpose: Selects which type of acquisition data is shown.

Type: Toggle (also first character select): *Timing / State.*

Effect: Changes type of display.

Default: Depends on the data acquired. If data is State only, the default is State; otherwise the default is Timing.

Data Source

New

Purpose: Determines the source of data to be displayed.

Type: First character select. Press the key of the initial letter of the following (i.e., N, R or C), or press *SELECT* to get a list of:

New: Newly acquired data.

Reference: Reference data. Shown as *Ref.*

Compare: Comparison of new and reference data. New data is shown with the differences from the reference data highlighted.

Effect: Changes information displayed.

Default: New.

Disassembler Parameters

Disa. On
Parameters

Purpose: Allows standard and disassembler-specific parameters to be changed. (This field is only present when a disassembler is loaded.)

Type: popup menu. (Press *SELECT* to show the "Disassembler Parameters Menu" beginning on page 101).

Effect: Changes display presentation.

Dial Operation

Dial: Y

Purpose: Shows what the dial does.

Type: Information. The Dial field shows the current use of the dial, depending on which field the dial was last used.

Operation: To change the dial field, highlight one of the following fields and move the dial:

R: The dial moves the R cursor.

S: The dial moves the S cursor.

Y: The dial moves the displayed values relative to the center of the display, the Y cursor.

Mode

Mode: Line

Purpose: Selects how the dial moves.

Type: First character select. Press the key of the initial letter of the following (i.e., L, P, F, etc.) or press *SELECT* to get a list of:

Line Moves one line per "click". Clockwise is down, anti-clockwise is up.

Page Moves one display page per "click".

Level Moves the marker to the next (previous) sequence level transition.

Find Moves the marker to the next (or previous) new occurrence of the selected word. When selected, the extra find row containing the find words is visible. This column also contains the number of the occurrence. A negative number indicates a position before the trigger point.

Different
Only when Data Source field is *Compare*. Moves the marker from one difference between new and reference data to the next in the direction the dial is turned. If a signal is highlighted, then the dial moves the marker from difference to difference in that signal only. If any other field is highlighted, the dial moves the marker to the next difference in any signal displayed.

Equal Only when Data Source field is *Compare*. Moves the marker from one equality of new and reference data to the next in the direction the dial is turned. If a signal is highlighted, then the dial moves the marker from equality to equality in that signal only. If any other field is highlighted, the dial moves the marker to the next equality in any signal displayed.

Effect: Changes effect of the dial.

Default: Line.

Cursor Difference R-S

R-S: -2314 ns

Purpose: Shows the difference between the number of samples or times at the R and S cursors.

Type: Information.

Label Name

a

Purpose: Labels the data column and allows it to be replaced or deleted, or a new data column to be inserted. Also allows dial operation in Different and Equal modes for this signal only.

Type: First character select. Press the key of the initial letter of a label, or press *SELECT* to get a list of labels (as defined on the format menu).

Operation: Depends on the key pressed:

alphanumeric keys:
Replace the current label by the next label starting with the character pressed.

SELECT:
The List Group Selection popup menu appears showing all the available signal labels with the current label

highlighted. Highlight the required label, and press *SELECT* to replace the label.

Note that in addition to the defined labels, any clocks, the time and the level are also selectable.

DELETE:

When on this field, you can delete this label from the display. At least one label must remain on the display.

INSERT:

The List Group Insertion popup menu appears showing all the available signal labels with the current label highlighted. Highlight the required label, and press *SELECT* to insert that label to the right of the current one.

Default: All labels defined on the Format menu are shown (or are present if there are more than can be shown), in the order defined, plus clocks, in the order defined, Time, and Level.

Base of the Data

+ Hex

Purpose Shows whether the time under the Time label is absolute or relative, and allows it to be changed. For other labels, shows the base of the data displayed for that label and allows it to be changed.

Type: First character select:

For Time labels:

Abs (Absolute): shows the time from T_0 (+ or –). See sidebar on page 98 about T_0.

Rel (Relative): shows the time from the previous line.

For Data labels: *Binary; Octal; Decimal; Hexadecimal;* or *Ascii.*

Press the initial letter of the option, or *SELECT* to get a list.

For Ascii values, non-printable characters (out of the range 32 through 127) are shown as a dot.

Notes: The base is shown as two characters when the associated pattern definition (below) is two or less characters wide, and as four characters otherwise. The character used is the first character of the base name (B, O, D, H or A).

The + or – character reflects the polarity of the signal set on the Format menu. It is for information only and cannot be changed here.

For Clocks either a tick (✓) or nothing is displayed. If the tick is displayed, the samples on that line were captured by that clock.

Effect: Changes the representation of the data.

Defaults: For Time: Absolute.

For Data: Hexadecimal.

DISPLAY

Spec.Fcns.

SELECT

Display Special Functions Menu

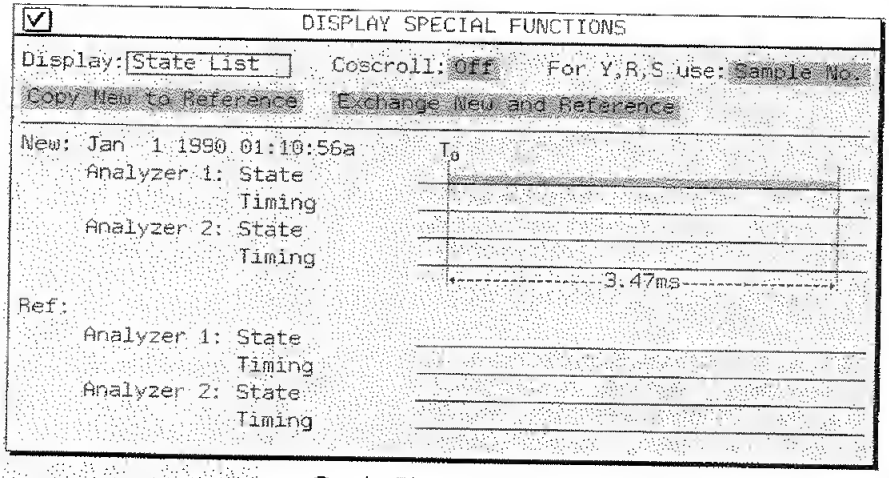
Menu Access

The Display Special Functions menu is accessible from any Display Screen (*DISPLAY* key) by moving to the field marked *Spec.Fncs.* and pressing *SELECT*.

Menu Purpose

This menu allows special display functions to be switched on or off. It also allows you to move data from New to Reference memory and vice versa.

In addition, the menu gives an overview of the relative proportions of the data captured by the analyzers' state and timing sections for both new and reference data.



On the Display Special Functions menu, the options described below are available.

Display Type

Purpose: Shows the type of display.

Type: Information:

Waveform: Timing display

State List: State display

Time Origin – T_0

If there is only one trigger point in memory (*newly* acquired timing *and* state data for *both* Analyzer 1 and 2), then that is taken as T_0. If there is more than one such trigger point, then that trigger point with the earliest time is the time origin.

In either of these cases, samples occurring *before* T_0 will then have a negative value.

If there is no trigger point in memory (the trigger has been lost) then the oldest sample in memory is taken to be T_0.

Coscrolling

Coscroll Off

Purpose: When two windows are displayed, this option can be set to scroll the displays either together or separately.

Type: Toggle: *On / Off.* You are prompted if the X cursor of the Timing display and the Y cursor of the state display should be aligned.

Effect: Changes how displays are scrolled. When co-scroll is on, the movement of the displays is synchronized.

Default: Single display: Off.
Dual display: On

Sample Number Fields

For Y,R,S use: Sample No.

Purpose: (State display only) Causes the values shown in the Y, R and S fields of the State Display menu to be switched between sample number and time.

Type: Toggle: *Sample No. / Time.*

Effect: Changes Y, R and S fields of the State display.

Note: This field is only shown for special functions related to a state display.

Default: Sample numbers.

Copy New to Reference

Copy New to Reference

Purpose: Copies newly acquired data to the reference memory.

Type: Function: The new values are copied to the reference memory. This is immediately made

visible in this menu in the lines indicating memory usage.

Effect: Copies newly acquired data into the reference memory, changes the reference screen, if displayed, and the memory usage reference information in this menu.

Exchange New and Reference

Exchange New and Reference

Purpose: Causes the reference and new data to be exchanged.

Type: Function: The new and reference values are exchanged. This is immediately visible in this menu in the lines indicating memory usage.

Effect: Exchanges data in the new and reference memory, changes the values and display of reference and new data, and changes the memory usage information in this menu.

DISPLAY

Parameters

SELECT

Disassembler Parameters Menu

Menu Access

The Disassembler Parameters menu is accessible from any Display Screen (*DISPLAY* key) when a disassembler is activated, by moving to the field marked *Parameters* and pressing *SELECT*.

Menu Purpose

This menu allows specific parameters controlling the disassembly process and its output to be specified.

```
☑                    DISASSEMBLER PARAMETERS
Display   - Program Context Mode: Yes
            Show Data Transfers:  Yes

Translate - Restart: No , with Auto  sync
            Options: Address-Mode = Real
```

The disassembler parameters menu is shown above. The fields on this menu are grouped in two sections:

Display This controls which state samples are shown.

Translate This controls the disassembly process.

Note that the *Options* field is not present on this popup menu for all disassemblers. It is shown here for reference purposes only.

Program Context Mode

Program Context Mode: Yes

Purpose: Determines if all instructions fetched by the microprocessor are displayed, or only those instructions that have actually been executed.

Type: Toggle:

Yes: Causes state samples to be displayed according to the following three rules.

1. Only state samples related to executed instructions are displayed. Instructions near program transfers (e.g., jumps or branches) or program exceptions, fetched but not executed, are not shown.
2. State samples shown are displayed in the same order as the instructions executed. All the state samples making up one instruction are shown together. They are immediately followed by any state samples

representing either memory or I/O transfers caused by that instruction if not suppressed by *Show Data Transfers* (see field below).

3. State samples not relevant to the disassembler are not shown (e.g., samples captured with external clocks not defined by the disassembler).

Note: The first two rules are only applicable for microprocessors which have a pipelined architecture. The third rule applies to both pipelined and non-pipelined microprocessors.

No: All state samples not suppressed by *Show Data Transfers* (see field below) are shown in chronological order. However, an indication is given whether the opcode was executed or not.

Effect: Changes display of state data.

Default: Yes.

Show Data Transfers

Show Data Transfers: Yes

Purpose: Determines if state samples representing memory or I/O activity are displayed or not.

Type: Toggle:

Yes: State samples representing memory or Input/Output activity are shown.

No: State samples representing memory or Input/Output activity are not shown.

Effect: Changes display of state data.

Default: Yes.

Restart

Restart: No

Purpose: Determines whether a new translation (disassembly) should be performed on the current measurement.

Type: Toggle:

Yes: Perform a new disassembly as soon as the disassembler parameters menu is closed.

No: Do not perform a new disassembly when the disassembler parameters menu is closed.

Default: No.

Synchronization

Restart: No , with Auto sync

Purpose: Determines how the disassembler searches for proper instruction starting points.

Type: Toggle:

Auto: The disassembler searches for the proper instruction starting points in the whole measurement, starts disassembling from the first found with automatic self-correction.

Manual:
The disassembler assumes the sample at the Y cursor position is an instruction starting point and starts disassembly from there.

Note: For microprocessors with a data bus wider than eight bits extra fields *at Y:* are shown if

manual synchronization is selected. See *at Y* field description below.

Effect: Search for instruction starting points.

Default: Auto.

At Y

at Y: XX

Purpose: Determines which part of the data bus should be used by the disassembler as the instruction starting point for manual synchronization.

Type: Toggle:

XX: (one X per nibble)
The part of the data bus related to this field is used by the disassembler as the instruction starting point for disassembly.

blank: The part of the data bus related to this field does not represent an instruction starting point.

Notes: This field is only shown if Manual synchronization is selected and the microprocessor data bus is wider than eight bits.

Only one *at Y:* field can have *XX* assigned to it at a time. Toggling any *at Y:* field to *XX* automatically causes the other fields to be set to blank.

Effect: Sets the instruction starting point for manual synchronization.

Default: Field representing the part of the data bus on which the least significant part of an instruction is transferred.

Options

Options: · · · · · ·

Purpose: This field provides additional options for the disassembler. It is disassembler-specific, and may not appear for those disassemblers that have no additional options.

Type: Toggle or List depending on the disassembler. (See the user documentation released with the disassembler for more information. These pages should make an appendix to the *User Manual*.)

Note: You can use the blank space below to make your own notes about your disassembler's additional options.

PRINT

Print Menu

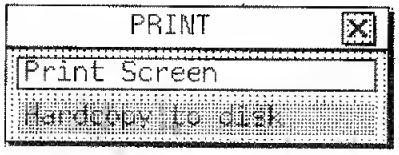
Menu Access

The Print Menu can be accessed at any time by pressing the *PRINT* key.

Menu Purpose

This menu allows a hard copy of the current status of the instrument to be made on any attached printer, or to a file on disk for post-processing by an application program.

The Print menu is a popup menu as shown below, which allows you to print the current screen to a printer or to a file on disk. The menu is built from the following fields.



Print Screen

Print Screen

Purpose: Prints the current screen (without the print pop-up menu).

Type: Function.

Operation: During a printout, the operation can be stopped by pressing any key on the instrument. A confirmation screen appears; if you respond "no", do not stop, the printout continues, otherwise it is aborted.

Dump Screen

Hardcopy to disk

Purpose: Copies the current screen (without the print pop-up menu) to a file on the floppy disk called SCREEN.HC.

Type: Function.

Cancel

X

Purpose: Removes the pop-up menu and returns with no further action.

Type: Function.

RUN

Acquisition Progress Display

Menu Access

Acquisition can be started at any time by pressing the *RUN* key. The Acquisition progress display is then shown.

Menu Purpose

Shows the progress of the acquisition if it lasts more than about 1/2 a second.

The Acquisition progress display is a popup menu as below, which shows you how the acquisition is progressing.

```
ACQUISITION PROGRESS
Analyzer 1:  1

Analyzer 2:  Inactive
```

The numbers represent the levels the sequencer goes through. Since the sampling is done by the processor, if the rate of change of levels is greater than about 1 millisecond, levels may be missing.

Also repeating levels are not shown. However, this means that if the sequencer is stuck at a level, that level number will be shown and the progress display will not change.

Other than level numbers, the characters S or T may be shown:

S	indicates that the sequencer is stopped.
T	indicates that the trigger condition has been found.

A
Abort printing 108
Absolute time 94
Acquisition progress display 109–110
Activate analyzer 11
Active analyzer indicator 6
Activity indicator 6, 12, 17
Add label 20
Add new level 51
Add qualifiers 27
Add signal 81, 93, 94
Add Trigger words 60
After clause 49
After condition 52
  selecting 52
Analyzer
  activity indicator 6
  After signal from other 52
  reset 11
  status 11
  trigger 56
Analyzer name
  Configuration menu 10
  Format menu 17
  State list display 87
  Timing display 73
  Trace menu 37
Areas of Trace menu 34
Arrow assigning pods 12
Arrow keys 7
  Format menu 16
  Trace menu 34
Ascii label 62, 95
Assigning clocks 19
Assigning pods 12
At Y field 105
Attributes of clock 25–27
Attributes of data labels 29–31
Auto data storage 39
Auto sync 104
Autoload definition 69
Auto-repeat 6, 42
Auto-repeat run parameters 42

B
Base for trigger words 62
Base of the data 94
Begin position of trigger 40
Binary label 62, 95
BNC connectors 3
  After signal from 52
  output trigger 57
Branch conditions 53
Branch expression 56
Brightness control 4
Bus fields 82
Bus in label selector 24

C
Cancel field 67, 68
Cancel print field 108
Cancel printing 108
Center of display
  State list 88
  Timing display 75

Centronics connector 3
Change analyzer name 10
Change display type 77, 90
Change label name 22
Change of state detection 35
Change R and S positions 76, 89
Change X position 75
Channel activity 12
Channel Select Fields, keys in 20
Channels for data 24
Check fields 5, 51
Clock
  Adding 20
  Display position 27
  for timing data acquisition 26
  Labels 18, 26
  Patternss 36
  Polarity 19
  Qualifier expression 19, 22, 27
  Selector 20
  State expression 54
  storage selection 51
  Used for trigger 60
  Validity 31
Clock Attributes Menu 25–27
Colors of fields 6
Compare data display 78, 91
Comparing patterns 62
Condition fields 53
Condition met branch 56
Configuration Menu 9–13
Connectors 3
Copy file 69
Copy new to reference 99
Coscrolling 99
Cursor difference field 80, 93
Cursor keys *see arrow keys*
Cursors
  coscrolling 99
  R and S 76, 89
  R-S difference 80, 93
  X 75
  Y 88

D
Data acquisition progess 109–110
Data between patterns 36
Data comparison 43
Data display
  State list 86
  Timing display 72
Data label
  adding 20
Data label as state data 31
Data Label as timing label 30
Data labels 22
  adding 20
  Selection 24
Data Labels *see also Labels*
Data polarity 23
Data shown 77, 90
Data source field
  State list 91
  Timing display 77

Data storage
  for clock 26
  for label 30
  memory 39
  type stored 39
Data storage *(see also Store)*
Data storage + Triggering 26, 30
Deactivate analyzer 11
Decimal label 62, 95
Define autoload 69
Define storage type 39
Delay sequence 55
Delete file 70
Delete key 7
Delete level 51
Delete qualifiers 27
Delete signal 81, 93
  State list display 94
  Timing display 82
Delete trigger words 60
Demultiplexing of data 27
Detecting glitches 35
Dial mode moving 79
Dial moving 92
Dial operation 81
  Menus, Lists and Pop-ups 7
  State list display 91
  Timing display 78
Different mode 79, 92
Disable analyzer 11
Disassembler parameters field 91
Disassembler parameters menu 101–106
Disassembler switch field 88
Disassembler synchronization 104
Disassemblers, loading 11
Disk formatting 70
Disk operations *see Input/Output menu*
Disk options 11
Display definition
  State list display 86
  Timing display 72
Display disassembler parameters 102
Display locator 74, 86
Display menu
  State 85–95
  Timing 71–83
Display on same line as clock field 27
Display position, clock 27
Display special functions field
  State list display 90
  Timing display 77
Display special functions menu 97–100
Display special functions menu selection 77, 90
Display type field 98
Display type shown 77, 90
Displayed analyzer 87
Displayed value field 80
Displays
  coscrolling 99
Division
  Mode 79
  Scale 74
  Timing display 73, 74
Double windows 74

Dump screen to file 108
Dump screen to printer 108

E
ECL threshold field 17
Edge
  in state predefined sequence 47
  mode 79
  of clock signal 20
  Trigger Word 59
Edge detector pattern 35
Edge during tw8>t8 sequence 45
Edit state expression menu 53
Edit storage expression menu 50
Edit timing expression menu 54
Editable fields 4
8-bit serial pattern predefined sequence 47
Enable analyzer 11
Enable disassembler 88
End position of trigger 40
Equal mode 80, 93
Exchange new and reference 100
External clock and data label 31
External clock for sampling 60
External clock selection 20
External clocks *see also Clock*

F
Field colors 6
Field Types 4
File field 67
File load 68
File output 108
File save 69
Files
  Autoload definition 69
  Copying 69
  Deleting 70
  Load new and settings 68
  Renaming 70
Filters
  patterns 35
  Time 60
Find mode 92
First character select fields 5
Floppy disk files *see Input/Output menu*
Floppy disk formatting 70
Floppy disk options 11
Format disk 70
Format Menu 15–24
Front Panel 2
Function fields 6
Fuse location 4

G
Glitch
  Detector patterns 35
  Mode 79
  Storage 39
  storage selection 39
  Trigger Word 59
Glitch during tw8>t8 sequence 45
Global store condition 50
Goto condition 56

H
Hardcopy to disk 108
Hardcopy to printer 108
Hexadecimal label 62, 95
Hexadecimal value fields
  Timing display 83
Home key 7

I
I/O pop-up menus 67
If condition 53
Immediate predefined sequence 47
Immediate state word patterns 36
Inactive analyzer field 11
indicator 6
Information fields 4
Initial character select fields 5
Initializing floppy disk 70
Input/Output menu 65–70
Insert clock 20
Insert new level 51
Insert qualifiers 27
Insert signal 81, 93
Insert trigger words menu 60
Integer fields 4
Intensity control 4
Interfaces 3
Introduction 1–7

K
Keys in channel select fields 20

L
Label Attributes Menu 29–31
Label`s base 62
Labels
  Base 62, 94
  Clock 18, 26
  Clock attributes 25–27
  Clock, adding and deleting 20
  Data 22
  Data attributes 29–31
  Data, adding and deleting 20
  External clock validity 31
  For timing/data 30
  Name on state list display 93
  Name on timing display 81
  on state list display 86
  Radix 62, 94
  Selector 24
  Timing data acquisition 30
  Timing display 72
Last user-defined sequence 47
Level
  Adding 51
  Branch 56
  Construction 49
  Delete 51
  Fields on timing display 83
  Mode 79, 92
  Number field 51
  Options 51
Level options menu 52
Line mode 92

List display menu 85–95
List fields 5
List group insertion menu 94
List group selection menu 93
Lists, moving in 7
Load new and settings 68
Loading disassemblers 11
Logic of qualifier expressions 22
Logic, positive and negative 19
Logical high level 23

M
Mains lead 4
Manual synchronization 104
Matching patterns 35, 62
Maximum pulse sequence 45
MEAS.AUT file 69
Memory and trigger point 40
Memory and type of data stored 39
Menu bar 6
Menu printing 108
Menus, moving in 7
Merge state data 27
Minimum pulse sequence 45
Mode field
  State list display 92
  Timing display 79
Monitor connector 3
Moving
  Between areas of Trace menu 34
  Dial 79, 92
  In Menus, Lists and Pop-ups 7
  R position 76, 89
  S position 76, 89
  X position 75
  Y position 88
Multiple clocks on display 27
Multiple matches 55

N
Name of Analyzer, changing 10
Negative logic 19
New acquired data display 77, 91
New data loading 68
New data save 69
New/Reference field
  State list 91
  Timing display 77
Not Range patterns 36
Not state word patterns 36
Number base 62, 94
number base 62
Number of times 55
Numeric fields 4

O
Octal label 62, 95
ON/OFF switch 4
Option field 11
Options at level 51
Options for disassemblers 106
Or if condition 53

P
Page mode 79, 92
Panel
  Front 2
  Rear 3
Parameters for a run 42
Parameters for disassemblers 91, 101–106
Pattern fields 62
Pattern recognition 35
Patterns
  Clock 36
  Edge 35
  filters 35
  Glitch 35
  Immediate 36
  Not patterns 36
  Range 36
  State words 35
  TimeWord 35
  Timing 35
Pods
  Activity 12, 17
  Assign to analyzer 12
  Field 12
  On format menu 16
  Scrolling 16
  Status 12, 17
  Threshold level 17
Polarity
  Clock 19
  Data 23
  Timing display 83
Pop-up menus 5
  I/O menu 67
  Moving in 7
Position of trigger point 40
Positive logic 19
Predefined sequences 44–47
  selecting 38
Predefined state sequences 46
Predefined timing sequences 45
Preparing floppy disk 70
Print Menu 107–108
Print screen 108
Printer connector 3
Program context mode 102
Progress of Acquisition 109–110
Pulse duration sequence 45

Q
Qualifier expression 19, 22, 27
Qualifier expressions
  Logic of 22

R
R position field
  State list 89
  Timing display 76
Radix of label 62, 94
Range
  Trigger word 60
Range not patterns 36
Range patterns 36
Range predefined sequence 46

Real fields 4
Rear Panel 3
Recognizing patterns 35
Reference data display 77, 91
Reference data storage 99
Reference to new data 100
Relative time 94
Remove file 70
Remove level 51
Remove qualifiers 27
Remove signal 81, 93
Remove trigger words 60
Rename file 70
Rename label 22
Renaming analyzer 10
Repeat mode timer 6
Repeat times condition 55
Repeating run mode 42
Repeating run parameters 42
Replace signal 81, 93
Reset analyzer 11
Reset system 13
Restart condition 53
Restart disassembler 104
Restart predefined state sequences 46
Restart sequences 45, 48–57
  selecting 38
Retreive settings 68
Return field 67
R-S field 80, 93
Run definition area 37–43
Run menu 109–110
Run mode 42
Run parameters 42

S
S position field
  State list display 89
  Timing display 76
Sample number at Y position 88
Sample number fields 99
Sampling clock 60
Save new and settings 69
Save reference data 99
Scale divisions 74
screen brightness control 4
SCREEN.HC file 108
Scroll mode 79
Scrolling
  Format menu 16
  State list display 88
  Timing display 75
Scrolling displays together 99
Select analyzer on Trace Menu 37
Select channels for data 22
Select clock channel 20
Select Fields, keys in 20
Select trigger words 59
Selector
  Label 24
Sequence
  Goto 56
  Last user-defined 47
  Time-out 55
  Times 55

Sequence branching 53
Sequence selection 38
Sequence type 38
Sequencer area 48–57
Sequences
  State 46
  Timing 45
Serial pattern predefined sequence 47
Set trigger word menu 59
Settings
  Loading 68
Show data transfers 103
Signal activity 12
Signals of a bus 82
Single run mode 42
Software options 11
Source of data shown 91
source of data shown 77
Special functions menu 97–100
Split screen display 71, 85
State analyzer trigger 56
State clock patterns 36
State clocks *see also Clock*
State data and memory 39
State display
  Time numbers 99
State Display Menu 85–95
State expression menu 53
State List Display Menu
  Layout 86
State only storage 39
State sequences 46
State storage selection 39
State word immediate patterns 36
State word patterns 35
State words not patterns 36
State/Timing field 77, 90
Status, Analyzer 11
Step mode 79
Stop printing 108
Storage expression 50
Store clause 49
Store condition 50
Store field 50
Store list 50
Store new data 69
Suspend sequence 52
sw1 etc. sequences 46
sw1 through sw8 patterns 35
sw12 through sw78 patterns 36
Swap new and reference 100
Switch analyzer on and off 11
Switch Analyzers
  Timing display 73
Switch analyzers 37
  State list display 87
Switch disassembler on/off 88
Switch off analyzer 11
Switching Analyzers 17
Symbolic label *see labels* 22
Synchronization 104
Synchronizing X and Y 99
System reset 13

T
T/Div field 74
T0 98
t7 45
Threshold fields 17
Tick mark 5
Time at Y position 88
Time filters patterns 35
Time interval 73
Time label base 94
Time of the data 75
Time origin – T0 98
Time per division field 74
Time tags and memory 39
Time-out conditon 55
Timer indicator 6
Times condition 55
TimeWord 59
TimeWord pattern 35
Timing
  Analyzer trigger 56
  Data only selection 39
  Expression 54
  Label field 26, 30
Timing data and memory 39
Timing display menu 71–83
Timing label replacement 81
Timing only storage 39
Timing patterns 35
Timing sequences 45
Timing word filter 60
Timing+Glitch storage 39
Timing+State storage 39
To field 68
Toggle fields 5
Trace key on Trace menu 34
Trace Menu 33–63
  layout 34
  moving on 34
  Predefined sequences 44–47
  Run definition area 37–43
  Sequencer area 48–57
  Trigger words area 58–63
Transfers, show 103
Translate disassembly 102
Translate*see also disassembly*
TRIG connectors *see also BNC connectors*
TRIG IN connector 3
TRIG OUT connector 3
Trigger
  Clause 49
  Field 56
  Menu 56
  Output 56
  Point in memory 98
  Position 40
  Selecting condition 52
  User-defined position 41
  Wait for signal 52
  Word 59
Trigger pulse 3
Trigger words 59
  Base 62
  Clock used 60